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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

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New Top People

SELECTION of a State corporation's board is the prerogative of a Minister, and it is an unenviable task. The appointments of Sir Gerard d'Erlanger and Sir George Cribbett as BOAC's chairman and deputy chairman in 1956 showed how difficult it is to satisfy a corporation's executive management on the one hand and the trade unions (who can make or break BOAC) on the other.

No one, it seems, is offended by the new appointments to BOAC's board. There are those who ask: Why put a man with no airline experience in charge of the nation's biggest airline? Had the Minister put an air-transport strong man in the chair there would, in view of the firm control that Mr Basil Smallpeice now exerts, have been two chief executives—and that simply would not have worked. Instead, we have at BOAC's summit Sir Matthew Slattery, a man steeped in British aviation, who knows what is expected of a public servant, who has a reputation for good humour, good sense (with one possible lapse when he insisted that BEA should have an aeroplane it did not want), and intense loyalty to his staff.

The appointment of Sir Wilfred Neden, the industrial relations expert, as deputy chairman emphasizes that BOAC's labour problems are still of daunting complexity. There are no fewer than 17 unions represented on the National Joint Council, the management-labour consultative machinery upon whose smooth working largely depends—as the BOAC strike of 1958 illustrated—the success of the corporation's fight to cut engineering costs, and to fly back into the black. Sir Wilfred is known as the great peacemaker; let us hope that the less responsible elements will not be encouraged to think that he is the great appeaser.

But above all let us hope that BOAC's new board structure (this is the Mk 3 version since 1949) will be the right one. Sir Miles Thomas was full-time chairman and chief executive; Sir Gerrard d'Erlanger was part-time chairman with Mr Smallpeice as chief executive; and Sir Matthew is whole-time chairman, with Mr Smallpeice again as chief executive, a function that he has ably performed for the past four years, and which Sir Matthew will be wise not to circumscribe.

The Unseen FAA

AT the last three SBAC Flying Displays pilots of the Royal Navy, in Sea Hawks and Scimitars and helicopters, put on some notable performances. Sad, then, that the Admiralty's decision not to participate at Farnborough this year means that the public at large will have no opportunity of seeing FAA aircraft in 1960; for Naval Air Days are at stations remote from population centres.

The Admiralty have stated (*Flight,* last week) that they cannot participate at Farnborough because of the intensive programme of introducing new aircraft into carrier service. This presumably refers chiefly to the D.H. Sea Vixens, which many people confidently expected would be flown in the SBAC display with the *élan* exhibited by Naval pilots last year in their Scimitars.

No one doubts that the Admiralty's decision is sincere: the villain of the piece is presumably the operational and economic planning which lays down to the last minute the amount of flying which can be done, leaving no flexibility for display appearances and the practice involved. These shows are as important in peacetime as operations and excellent for both professional and public morale: moreover, Farnborough attracts an international clientele. The Fleet Air Arm's contribution is understandably smaller than that of the RAF, but should be made. Ten minutes' flying is worth a hundred explanations—and a thousand recruiting posters.

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FROM ALL QUARTERS

TSR.2 Reappraised

AT present the British Aircraft Corporation's TSR.2 is the only new supersonic military aeroplane under development in the British Commonwealth. It is, therefore, a matter for regret—though by no means unexpected—that the Treasury is reported to have asked the Chiefs of Staff and Minister of Defence to re-evaluate it and ascertain whether its roles could not be fulfilled by a cheaper aircraft developed to a much earlier time-scale.

It may be recalled that the original Air Ministry requirement for a "Canberra-replacement" multi-purpose tactical aeroplane was drawn up more than two years ago as OR.339. The requirement was finalized only after protracted discussion; and a further display of eloquence by those who wanted the aircraft (the RAF) and those who felt it would be very nice if it could be dispensed with (the Treasury) delayed progress until the project was allowed to go ahead on January 1 last year (*Flight* January 9, 1959, page 54). The contract for the development of the TSR.2 aircraft was placed with Vickers-Armstrongs (Aircraft) who were to share the work "on a 50-50 basis" with English Electric Aviation. Both firms are now members of the new corporation; progress has been generally satisfactory, and actual construction of the first TSR.2 is due to start shortly.

Throughout the life of the project there have been many who have believed that the Blackburn NA.39 could do almost as good a job; and the Treasury have at last become so concerned at the rising estimated cost of putting TSR.2 into squadron service that they have succeeded in having the whole case re-opened. The TSR.2 will be a large and capacious aeroplane, capable of carrying everything needed to fulfil all kinds of tactical missions. Its field performance could be superior to that of the NA.39, and its maximum speed approximately twice as great. On the other hand it will be at least twice as expensive. It may be that the Treasury will force the conclusion that the programme is not worth the money. It might be reasoned, of course, that it could have been shown that the new monoplane fighters of 1936 were not, in their day, worth while.

One thing at least seems clear: no major British weapon system is in future going to be allowed to proceed from inception to operation without becoming the centre of a hornet's nest of controversy. This is already the case with all British guided weapons, and TSR.2 can hardly expect to be an exception.

SBAC Council, 1960-1961

THE council of the Society of British Aircraft Constructors has elected Sir George Dowty as its president for 1960-61, with the Hon George Nelson as vice-president. Sir Aubrey Burke, who was president in 1958-60, becomes deputy president. Sir Frederick Handley Page is re-elected treasurer.

Sir George is founder, chairman and managing director of the Dowty Group. The Hon George Nelson, managing director of the English Electric Co, chairman of English Electric Aviation and deputy chairman of D. Napier and Son, was last May elected a deputy chairman of the recently formed British Aircraft Corporation. Sir Aubrey Burke is chairman and managing director of the de Havilland Aircraft Co and of de Havilland Holdings, chairman of the de Havilland Engine Co Ltd, and deputy managing director of the Hawker Siddeley Group. Sir Frederick Handley Page is, of course, chairman and managing director of Handley Page Ltd.

In addition to the above, the SBAC council for 1960-61 consists of 29 members and four associate members, as follows:—

J. J. Parkes, Alvis; H. M. Woodhams, AWA; J. A. R. Kay, AWA (Guided Weapons Division); F. Bates, Auster; A. F. Jopling, Blackburn; J. D. North, Boulton Paul; C. F. Uwins, Bristol; Sir Reginald Verdon Smith, Bristol Siddeley; H. T. Chapman, Bristol Siddeley; H. Buckingham, de Havilland Engines; H. G. Sturgeon, de Havilland Propellers; Viscount Caldecote, English Electric (Aircraft Division); D. C. Collins, Fairey; H. Burroughes, Gloster; G. C. D. Russell, Handley Page; J. T. Lidbury, Hawker; W. A. Summers, Hunting; H. Sammons, Napier; Sir Roy Dobson, Avro; Sir William Farren, Avro (Weapons Research Division); W. T. Gill, Rolls-Royce; J. D. Pearson, Rolls-Royce; D. L. Hollis Williams, Saunders-Roe; B. Boxall, Scottish Aviation; Rear Admiral Sir Matthew Slattery, Short Bros; R. P. H. Yapp, Vickers-Armstrongs (Supermarine); T. Gammon, Vickers-Armstrongs (Weybridge); E. C. Wheeldon, Westland; W. Oppenheimer, Westland (Bristol Division). *Associate members:* Materials Group, W. Hackett, Jnr, and H. G. Herrington; Equipment Group, T. Simpson and T. C. L. Westbrook.

S. G. Brown Ltd: £775,000

AS had been forecast in *Flight* (June 17), there was Opposition criticism when the sale of S. G. Brown Ltd to D.H. Holdings Ltd was discussed in the Commons on June 22, though it did not amount to a censure motion. Mr Frederick Lee (Lab, Newton) asked if there had been offers from a large number of British firms, and why they had been turned down "for a combination that includes the American Bosch Arma Corporation"? The Civil Lord of the Admiralty, Mr C. I. Orr-Ewing, said that other offers were received but this was the best; de Havilland would retain a 51 per cent controlling interest in the company. He refused to disclose the selling price, but under Opposition pressure said he would approach the buyers "and see if they have any objection."

Last Friday, in a written Parliamentary answer, Mr Orr-Ewing said that the price to be paid—in cash on June 30—was £775,000. This included repayment of Admiralty loans amounting to £215,000. The purchasers would also assume responsibility for a bank overdraft outstanding at £440,000.

The Rolls-Royce Year

IN his annual statement at the annual general meeting of Rolls-Royce Ltd on July 19, Lord Kindersley, the chairman, spoke of the contribution of the aircraft and engine industries to the country's export programme. "At the risk of repetition," he said, "it must be stressed that the record figures of exports for these industries for 1959—£156 million compared with £154 million in 1958—are the result of decisions taken and development work done many years ago. It has always been our belief that Government policy must recognize the vital importance of continuity of development by giving support to companies which are prepared to make a substantial contribution from their own resources. It is on this basis that our company has continued with programmes of development which have absorbed a substantial portion of our profits."

Among other points from Lord Kindersley's statement were remarks on the improved version of Conway to be used in the Vickers VC10; on the R.B.141, which began test-bed running late in 1959 ("we hope to see this new family of engines secure for us a satisfactory share in future jet-transport business"); and on progress with the Tyne.

Of the company's high-altitude test facility the chairman said that it had enabled Avon anti-icing tests to satisfy the ARB to be

SEVENTEEN MONTHS after the go-ahead in January 1959, the Avro 748 made its maiden flight — lasting 2¼hr from Woodford — on June 24 in the hands of Jimmy Harrison, Avro's chief test pilot. The type is due to be in service with the UK independents Skyways and BKS next summer. The Series 2 version has been ordered by Aden Airways. A full description of the 748 appeared in "Flight" for June 3, pages 757-764

***NEW BLOOD:** The first four-seater in the new Auster range, in this case a D.6 with a 160 h.p. Lycoming engine. It was flown to Norway recently by Ronald Porteous, Auster sales director. Future D.6s will have the 180 h.p. Lycoming and constant-speed propeller*

completed in a week, whereas flight-test methods would have needed six months.

Following the Short SC.1's success, other countries interested in VTOL development were now considering projects using Rolls-Royce engines.

Speaking of collaboration with foreign firms, Lord Kindersley said, "The interest of NATO countries in aircraft designed to use the Tyne engine has led to arrangements for the manufacture of this engine on a co-operative basis which will enable us to continue the happy associations which we have had with both Hispano Suiza in France and Fabrique Nationale in Belgium. In Germany negotiations which were proceeding with Maschinenfabrik Augsburg-Nurnberg A.G. have since resulted in the signing of an agreement for technical collaboration. In India licence arrangements have been concluded for the manufacture of Dart engines."

The chairman concluded his review of the work of the company's Aero Engine Division with a reference to Blue Streak. "Its cancellation," he said, "is naturally disappointing because your company had taken the initiative in arranging for technical collaboration with North American Aviation on the design and development of the powerplant. Although the project had not reached the stage of occupying any substantial part of our manufacturing resources, it represented an important part of our future programme and must inevitably involve some rearrangement in our forward planning."

Financial results announced in the directors' report at the meeting showed a gross trading revenue for the year ended December 31, 1959 of £97,533,321 (*1958, £92,277,918*), representing a profit after taxes of £2,634,854 (*£2,233,482*). Increase in revenue stemmed mainly from oil-engine sales.

SR-N2 Hovercraft

HOVERCRAFT collaboration is being continued between Hovercraft Development Ltd, a subsidiary of the NRDC, and Westland Aircraft Ltd (Saunders-Roe Division) under an agreement announced last week. Construction of the SR-N2, already under way at Cowes, will be continued as a joint venture.

In the announcement, it was stated that Westland, in addition to continuing their research programme on the SR-N1 with Hovercraft Development Ltd, had for some time—and as a private venture—been engaged on the design and testing of models of an advanced Hovercraft designated SR-N2. This is described as "a multi-engined 25-ton craft, designed for a wide range of operational tasks. It has a design speed of 70kt and will carry up to 68 passengers."

Technical details are withheld, pending finalization of the design. It is certain, however, that motive power will be provided by a number of free-turbine engines—four Blackburn A.129 Nimbus are a likely possibility—arranged as a package at deck level. Gearboxes and shafts will take the power to a pair of fans to provide lift in the Cockerell manner and to a pair of variable-pitch propellers which will be capable of pivoting in azimuth to simplify manœuvring in confined spaces.

It is expected that the SR-N2 will be operational by the autumn of next year, and those concerned in its development confidently expect that by that time someone will be ready to operate it commercially. Such operations would probably be in comparatively sheltered waters such as the Solent and around the Western Isles of Scotland.

This SR-N2 announcement, only a year and a week after the SR-N1 first flew, marks the beginning of a Hovercraft development industry in the UK. Vickers-Armstrongs (South Marston) Ltd are developing a 4-5 ton utility craft and a 15-25 ton transport (to be available in two years, or a little later than the new Saro machine). Denny Bros are working on a vehicle for commercial use and Britten-Norman's Cushioncraft was described last week.

Soviet Record Claims

RUSSIA claims to have set up a new speed record of 2 091km/hr (1,298 m.p.h.) over a 100km (62 miles) closed circuit. In a recent broadcast, Moscow radio said that this was set up on May 28 by Boris Adrianov in "a single-seater turbojet aircraft," the flight lasting for 2min 52.5sec. The broadcast added that "the Soviet Union holds both absolute world speed records," the other (over a distance of 15-25km) having been set up by Col G. Mossolov on October 31 last year, when he averaged 1,493 m.p.h. on two runs in an E-66. [An American record of 2,455.25km/hr (1,525½ m.p.h.) over a 15-25km course, set up by Joseph William Rogers in a Convair F-106 on December 15 last year, has not so far been confirmed by the FAI.]

The Soviet Union has also claimed two new helicopter records, for distance and speed, Moscow radio reporting that on June 18 the woman pilot Tatyana Russiayan covered a 500km (311 miles) closed circuit course non-stop in an Mi-1 at an average speed of 142.642km/hr (88.9 m.p.h.). Made along the Tushino - Kaluga - Vyazma - Tushino route, the flight lasted 3hr 31min 42sec.

***CUSHIONCRAFT DESIGNERS** John Britten (left) and Desmond Norman, whose promising air-cushion vehicle was the subject of a cut-away drawing and description in our last week's issue*

Croydon—a Postscript

LAST week (page 857), we remarked on the meagre attention paid to civil aviation in Croydon's millenary celebrations. Some amends were made on the final day (last Saturday) of the exhibition at the airport, when hitherto abortive negotiations with the Ministry of Aviation at last bore fruit and an aerial farewell ceremony took place.

During the afternoon a total of over 20 aircraft from the Surrey and Kent, Vendair and Redhill Clubs flew past, dipping wings in salute as they neared the terminal buildings and hangars. Finally, from an Auster of Vendair—piloted by Trevor Prytherch—a wreath was dropped in the centre of the field. It was inscribed "A salute to all the air pioneers who flew to and from Croydon Airport—they thrilled the world."

IN BRIEF

George Tilghman Richards, MBE, a founder member of the RAeS, died on June 22 in his 76th year. An engineer, he took part in developing the Cedric Lee annular monoplane at Shoreham in 1913.

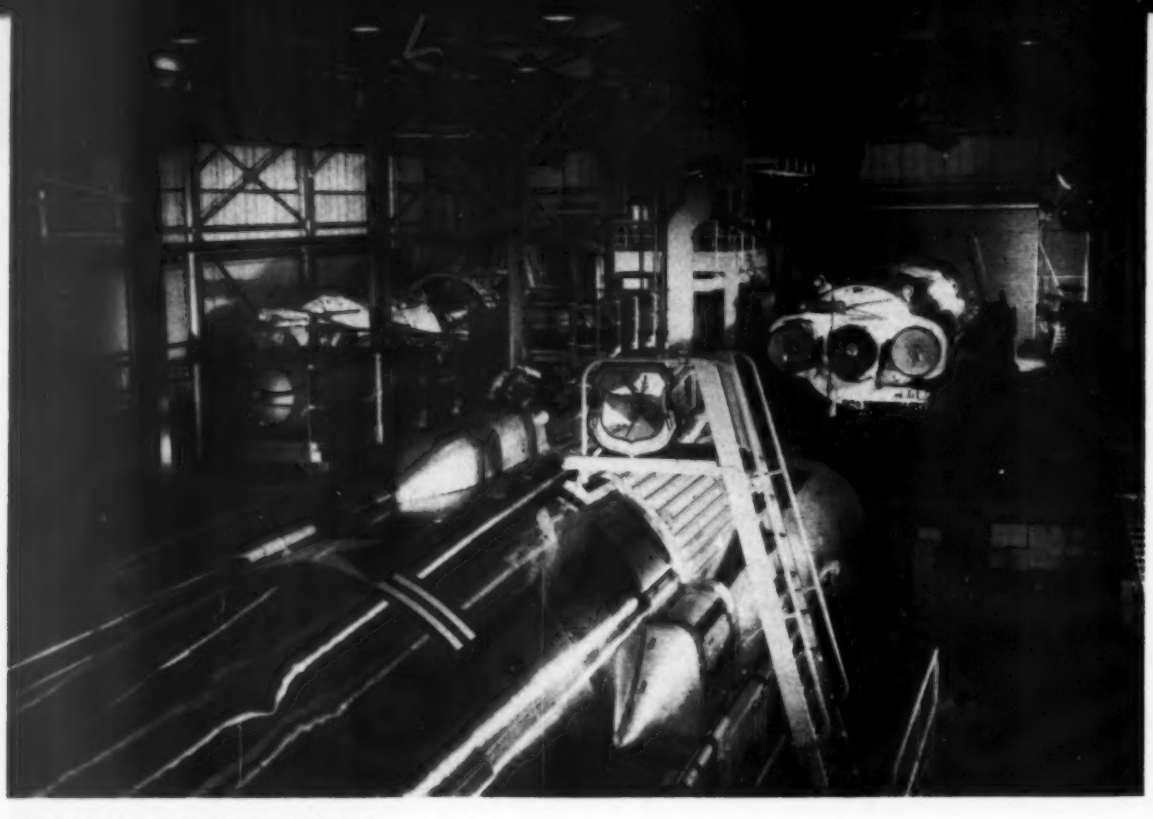
An addition to the list of Birthday Honours noted on page 863 last week is the name of Mr Raymond Smith, who is Rolls-Royce (aero) representative in Venezuela; he is appointed CBE.

It is reported from Paris that a Franco-Israeli agreement had been reached for the delivery of Dassault Mirage IIIs to the Israeli Air Force. According to informed sources, the agreement (concluded several weeks ago) provided for a first delivery of 26 aircraft and an option on a further 14.

Since "Forthcoming Events" on page 30 went to press the cancellation of the Derby and Lancs Gliding Club's meeting at Camphill (July 24-August 1) has been announced; but during the same period—though beginning on July 23—the Coventry G.C. is holding a Midland regional competition week at Edge Hill.

The Octave Chanute Award, given annually "for a notable contribution made by a pilot to the aeronautical sciences," was being presented yesterday (June 30) to Joseph J. Tymczyszyn at the national summer meeting of the IAS. Mr Tymczyszyn, a senior engineering test pilot and flight test engineer with the FAA, is flight test co-ordinator for the Douglas DC-8 certification programme.

Today's (July 1) issue of our associated journal *The Autocar* is a special number containing a full report of the Le Mans 24-Hour Race. Another topical special issue from Associated Iliffe Press is *Amateur Photographer* Holiday Number, appearing next Wednesday, July 6.

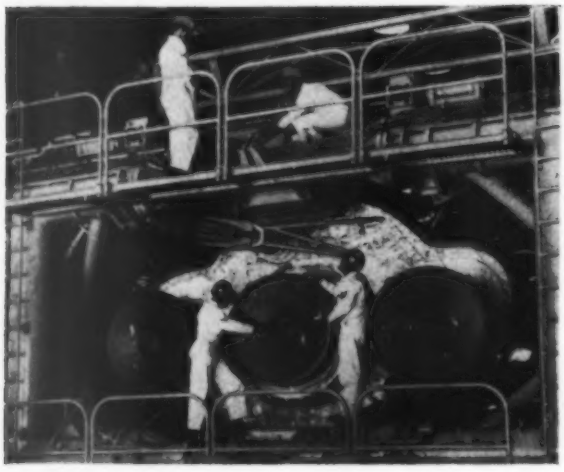


Missiles and Spaceflight

THE ATLAS ICBM IN SERVICE

ALTHOUGH any changeover in operating equipment as fundamental and complete as that from the bomber to the ICBM is bound to create vast problems, the USAF Strategic Air Command is showing that it can be done as a smooth and progressive operation extending over several years. Although in the future the current Atlas will appear a clumsy, vulnerable, temperamental monster, with a distressingly long reaction time, it is nevertheless an awesomely impressive weapon; and it makes a genuine contribution to what is generally called "the West's deterrent."

Atlas static testing was done at locations in sunny California—such as Sycamore Canyon and Edwards—while the flight-test programme was based at Cape Canaveral, Florida. The place chosen for the Atlas training and indoctrination centre is vast, sprawling Vandenberg AFB, on the California coast well north of Los Angeles. All missiles emplaced here can actually be fired in peacetime, along the Pacific Missile Range at targets in the neighbourhood of Wake Island (about 4,300 miles) and beyond. Much was written about this base in our June 10 issue. The "initial operational capability" Atlas missiles are at Warren AFB, near Cheyenne, Wyoming. This complex involves three squadrons, with three distinct types of hardness or deployment, all surrounding Cheyenne to a radius of some 30 miles.



Details have recently been given by the USAF of the overall scheduled deployment for Atlas missiles. Vandenberg is the base of the 1st Missile Division and the 576th Strategic Missile Squadron. All the missiles here are being put into soft or semi-soft emplacements. In fact, most are being installed in a manner which is almost a Chinese copy of that employed during the past three years at Cape Canaveral; the missile is positioned horizontally at the end of a sloping causeway and raised to the vertical position by cables from the top of a lofty servicing gantry, the latter being rolled out of the way shortly before a launch. Everything is exposed to the elements (and to enemy attack) and it is very doubtful if SAC regards Vandenberg as being anything more than a place of instruction.

A number of Atlas ICBMs at Vandenberg are being installed in horizontal emplacements. This may afford a trivial degree of hardness, but the new emplacement is designed essentially to provide some very necessary protection from the wind and the rain. Not only will this make life more bearable for the launch crews but it should also lessen the incidence of unserviceability and improve the life of everything in the emplacement. A picture of one of these horizontal launchers at Vandenberg appears at the top of the opposite page. On the left can be seen the roller-blind rear door, which is raised during firing. The three engines of the missile exhaust into a cement trough, draining into a large trench, and water sprays may be used to reduce the reach of the flames. Each emplacement carries enough fuel for at least two launchings; the RP-1 fuel tank is visible in the left background and the lox tank is on the right. In the left foreground are bottles of nitrogen for purging the propellant systems and missile, and various items of transfer equipment.

Francis E. Warren AFB is strictly operational. As we noted in our November 6 issue, the three squadrons located here are all deployed differently from their neighbours. The 565th SMS has two radio-inertial guidance emplacements (which, owing to the fact that their aerials are several hundred feet long, cannot be

Each Atlas ICBM at present consumes roughly the same number of maintenance man-hours as does an intercontinental bomber, but the human skills required and actual functions performed are often entirely different. As was noted in our June 10 issue, every missile at Vandenberg is recycled every 180 days back into the main maintenance base, in which the two pictures on this page were taken

In the accompanying text some notes are given on the semi-hard emplacement which is being employed at several Atlas bases. This shows one of the first to be constructed at Vandenberg

hardened at all), around each of which is grouped a trio of soft emplacements. The 564th have three such triple emplacements, while the 549th is truly dispersed in "Hollywood-hard" emplacements, each of which contains the missile entirely below ground-level until the countdown, all nine emplacements being remote from the others.

At SAC Headquarters at Offutt ARB near Omaha, Nebraska, the emplacements are all soft, there being three sets of three (as in the case of the 564th at Warren). Work is also well advanced at Fairchild (near Spokane, Washington) and Forbes (Topeka, Kansas), and both these bases follow the pattern of the 549th SMS in having nine individual semi-hardened emplacements. The remaining bases for which money has been voted for conversion to the Atlas will all house a single squadron of 12 missiles, each in a fully hardened silo of a design now being finalized. These bases are Schilling (Salina, Kansas), Lincoln (Lincoln, Nebraska), Walker (Roswell, New Mexico), Dyess (Abilene, Texas), Altus (Altus, Oklahoma), Plattsburgh (Plattsburgh, New York).

Total deployment of Atlas thus amounts to 123 missiles. Even excluding the cost of developing the missile itself, the total expenditure on putting these missiles into squadron service must be comfortably over $1,000,000,000. In view of the fact that Britain's calculated policy on "deterrence" is based on the contention that a fixed-based missile is economically unsound, it is worth noting that SAC can point to valid reasons why the Atlas bases do make a significant contribution to America's strength. The key factors are their wide dispersal, their great distance from any likely enemy and their sheer number. Each missile would have to be knocked out before its threat could be removed.

TRANSIT 2A

Photographs on this page depict the payload and the launching of the Transit 2A navigational satellite and an entirely separate, smaller satellite which parted from it in orbit. This was the first occasion upon which two distinct payload elements were launched together and arranged to separate and operate independently in orbit.

Major part of the payload was Transit 2A, one of a series of satellites intended to provide a future all-weather global navigational system for ships and aircraft. The first of this series, Transit 1B, was launched on April 13, and it successfully demonstrated the feasibility of the system. Transit 2A was fired from Cape Canaveral at 12.55 a.m. on June 21, and so far appears to have functioned admirably. Its orbit is almost circular; provisional apogee and perigee are 563 and 460 miles, and the period is 101.5min.

Transit 2A is essentially similar to the 1B satellite, the diameter being 36in and the weight 223lb. Almost the only superficial difference is the fact that the entire equitorial belt is covered by solar cells; the earlier Transit 1B had a smaller number of such cells, used to charge chemical batteries. In the space which chemical batteries would have occupied, Transit 2A carries an electronic digital clock, the transmission from which should provide a very accurate time standard at any given instant throughout a considerable proportion of the globe.

Few details of the small pick-a-back satellite have been divulged. Developed by the US Naval Research Laboratory, it contains a quantity of Canadian instrumentation and is intended to measure solar (Lyman-alpha and X-ray) radiation and radio noise from outer space generally. It separated from the Transit by springs, and is now travelling in orbit slightly ahead of its larger partner.

ANOTHER BLACK KNIGHT FIRING

The second successful firing of a two-stage Black Knight rocket from Woomera was announced by Allen Hulme, the Australian Minister of Supply, on June 21. A height of 300 miles was achieved and the point of impact of the nosecone was 70 miles down-range. Mr Hulme added that both rocket and range instrumentation "appeared to have functioned as planned." This was the seventh successful firing in the Black Knight programme since September 1958.

NASA LAUNCH ORGANIZATION OUTLINED

Today, July 1, the Development Operations Division of the US Army Ballistic Missile Agency formally transfers to the National Aeronautics and Space Administration as the George C. Marshall Space Flight Center, Huntsville. From this date a new unit in NASA, the Launch Operations Directorate, becomes operational to co-ordinate all the Administration's launch operations, headed by Dr Kurt H. Debus, formerly ABMA missile firing laboratory director.

In addition to its NASA activities the new directorate will complete the ABMA laboratory's current obligations to the US Army Ordnance Missile Command for the launching of Jupiter, Redstone and Pershing missiles. As launch operations director, Dr Debus will report to Dr Wernher von Braun, the Huntsville director; while NASA headquarters responsibility for launch activities, including the Marshall Center, comes under the Office of Launch Vehicle Programs whose director is Maj-Gen Don R. Ostrander.

On the left are seen the Transit 2A experimental navigation satellite surmounted by the NRL solar-radiation satellite. After injection into orbit on June 21, the two portions of the payload separated and are now circling the Earth in company, performing quite independent functions

Boost vehicle for the double payload was a Thor, and the second stage was an Able-Star. The departure from Cape Canaveral took place shortly after midnight on Tuesday, June 21

First public demonstration of the Australian-developed Malkara anti-tank missile took place at Lulworth, Dorset, on June 23. Adopted as a standard weapon for the British Army, it is wire-guided and carries a 60lb warhead. This specimen was firing over a range of 1,300yd

Missiles and Spaceflight . . .

ROCKETDYNE'S HYDROGEN ENGINE

The National Aeronautics and Space Administration announced last month that it would negotiate a contract with the Rocketdyne division of North American Aviation for the development of a liquid-hydrogen-fuelled engine of 200,000lb thrust. According to Rocketdyne this development will take about three years and will cost approximately $44m.

The new engine may be used in clusters of two or four to power upper stages of advanced configurations of Saturn. Initially it will be a single-start engine, but will be capable of modification for multiple starts in flight.

The initial Saturn will be capable of boosting 25,000lb into a 300-mile Earth orbit, or of sending 9,000lb on an interplanetary mission. Introducing a new second stage comprising two of the new engines would increase the weight-lifting capacity by almost 50 per cent.

The initial version of Saturn will consist of a first stage of eight engines producing 1.5 million pounds' thrust, a second stage of four 20,000lb thrust hydrogen engines and a third stage of two 20,000lb hydrogen engines. This is expected to come into use in 1963, and to be followed by the more advanced configurations in the late 1960s.

CONGRESS DETAILS

The subjects to be covered in the four specialized sessions to be held in conjunction with the eleventh congress of the International Astronautical Federation in Stockholm (August 15-20) have been announced by the Swedish Interplanetary Society. The space law colloquium will deal with (1) international control of outer space, and (2) damages to third parties on the surface caused by space vehicles, while the astrodynamics colloquium will cover (1) orbit determination, (2) perturbations and (3) orbit optimization.

The subjects of the space-medical symposium will be (1) man-machine systems in space vehicles, (2) biodynamics of manned lunar landing and return, (3) telemetering of physiological data from space capsules, and (4) biological significance of space ambient radiations. The final symposium, devoted to small sounding rockets, will be concerned with (1) sounding rockets, and a panel discussion on range and launching problems, (2) instrumentation and (3) problem areas.

US SPACE PROGRAMME REVIEWED

Following the annual general meeting of the Astronautics and Guided Flight Section of the Royal Aeronautical Society on Friday next, July 8, a lecture on the US space and astronautics programme will be presented before the section at the Institution of Mechanical Engineers, London, by Capt Robert F. Freitag, USN. The chairman of the section, A. V. Cleaver, will preside at this meeting, which begins at 6.30 p.m.

Capt Freitag has served continuously in the guided missile and rocket field since 1945, and his assignments have included the direction and establishment of the basic range instrumentation system for the Atlantic Missile Range, Cape Canaveral; head of the ballistic missile branch of the Bureau of Aeronautics, Navy Department, and project officer on Jupiter and Polaris missiles and the Vanguard Earth satellite. He was formerly planning officer at the Pacific Missile Range headquarters, Point Mugu, and in May was appointed astronautics officer in the Bureau of Naval Weapons of the Navy Department in Washington. Last October he was awarded the US Legion of Merit for his "outstanding professional skill and timeless devotion to the fulfilment of vital assignments" in connection with the Naval and national guided missile programmes between 1949 and 1959.

Minneapolis-Honeywell's anti-submarine Asroc was recently demonstrated off the Florida coast. A surface-to-underwater missile, it is powered by a solid rocket and can carry either a homing torpedo or a depth-charge as its warhead. It is scheduled for operational readiness next January

At Patuxent River recently, several Martin Bullpup air-to-surface missiles were fired from a Sikorsky HUS-1 of the US Marine Corps. One missile, fired from 1,500ft, hit "within inches" of an orange target disc 10,000yd out in Chesapeake Bay; that illustrated was fired from 500ft at 90 m.p.h.

"Flight" photograph

TWIN PIONEER SERIES 3 in the Air

By MARK LAMBERT

No 128 of the Series

AFTER many years in service, the Scottish Aviation Twin Pioneer still holds a leading position in the commercial STOL field—and the most recent development, the Series 3, now offers the unique qualification of meeting the British Group A, C and D and the American CAR.4B requirements. Main innovation in the Series 3 is the fitting of the Alvis Leonides 531/8, long-stroke, direct-injection engines which are giving an average 640 h.p. With two of these engines and a few small control modifications, the aircraft can now meet full airline single-engined performance requirements in that the failure of an engine at any time need not lead to a forced landing. The maximum gross weight has also been raised from 13,500lb to 14,600lb, which includes increased payload; and the guaranteed single-engined ceiling is 7,200ft at gross weight.

One of the great difficulties in putting the Twin Pioneer over to potential customers has been the limitations which have been imposed on its field performance by airworthiness regulations designed for normal airliners because its weight puts it just inside the full airline bracket. If it had weighed less than 12,500lb the regulations would not have been so stringent. But with the new engines, the major difficulties have passed.

For earlier Twin Pioneers the ARB slightly relaxed its requirements some eighteen months ago to allow short-field operation for public transport under less stringent, but still far from optimum, performance specifications. An "In the Air" handling report on the prototype Twin Pioneer appeared in *Flight* for November 25, 1955.

In the wake of the new engines have come a number of airframe modifications, among them the addition of fixed slots on each side of the centre rudder and a spring tab on the starboard elevator. Geared tabs are also carried on each outer rudder and geared tabs are standard on each aileron. The elevator is spring-loaded downwards to accentuate longitudinal stability. The high-lift system has been slightly altered so that the slats only extend with full flap (19½°) and not with intermediate flap (12½°). The engine nacelles are increased in diameter by 1in and pitot heads in each propeller slipstream serve engine-power-loss indicators—a Group A requirement. The Series 3 modifications may be retrospectively applied to convert earlier aircraft to the latest standard. A full electrical system is, of course, provided and airline radio may be fitted. De-icing by TKS strip and liquid is optional. Flaps and slats are hydraulically operated from a 2,500lb/sq in system supplied by a pump on each engine charging a single accumulator. The flap lever has two positions, intermediate and full, and an air bottle will extend full flap and slat should the hydraulics fail. Two additional accumulators serve the duplicated wheel-brake system, so that a failure in one circuit will disable only one of the brakes in each twin-wheel main undercarriage unit, leaving braking and steering available from the remaining pair. Control is by push-buttons positioned for toe operation on both the pairs of rudder pedals. No high-pressure hydraulics are within the cabin.

Throttle, pitch and trim controls are mounted on a pedestal between the two pilots and the duplicated control columns are mounted outboard and cranked inwards to sit in front of each pilot. Instruments and feathering buttons, extinguisher controls and magneto switches are on the main panel, but the propellers may also be feathered by pulling the pitch lever back through a gate. Priming, booster pump, idle-cut-offs, fuel cocks, cross-feed control, and starters are in the roof over the captain and circuit breakers are down the bulkhead behind the co-pilot. Radio controls are also in the roof, all these systems being within easy reach from the captain's seat. The Twin Pioneer is designed for one-pilot operation if necessary. The seats are fixed and fitted with shoulder harness and the rudder pedals may be adjusted by starwheel over a very long travel.

Visibility allows a view of the ground about 40ft straight ahead and the flaps can be seen inboard of the engine nacelles on the near side. Both wing-tips are clearly visible from either seat, and a window in the starboard roof gives the captain an inside view during right turns.

I flew the Series 3 Twin Pioneer at Prestwick with K. L. Trow, Scottish Aviation test pilot. We had four occupants, full tanks and ballast to bring the weight to 13,800lb and the c.g. to neutral. Almost all the sixteen, lightweight passenger seats were fitted in the cabin, together with a toilet. The very large freight door and rear floor parallel with the ground made access and loading easy, leaving the main cabin floor sloping fairly steeply uphill. We stepped up into the cockpit and climbed comfortably into our seats.

The booster pumps alone raised fuel pressure to 8lb/sq in ready for starting and pressure increased to 25lb/sq in for the direct-injection system as soon as the engines fired. The procedure was quite straightforward and remarkably similar to that of some of the larger American executive twins, though a ground battery was on this occasion connected. Cooling gills had to be open, but a short-circuit oil system allowed a quick warm-up. Pitch was checked right through to the feather position from 2,200 r.p.m. In keeping with airline standards, combined fuel/oil

"Flight" photographs

The Twin Pioneer's instrument panel is simple and uncrowded. On the pedestal are engine-control levers, trim wheels, flap lever and, below, fuel/oil cut-offs, oil cooler and intake filter levers. Note the button-operated toe-brakes. Switches and cocks are in the roof

TWIN PIONEER SERIES 3 in the Air . . .

cut-offs are provided, but fuel alone may be cut off if one engine must idle and therefore requires continued lubrication. A lever which also blocks the throttles may be pulled to lock the control surfaces on the ground.

I took over while taxying and found the brakes powerful and admirably adjusted for sensitivity. The throttle linkage, being of the enclosed cable type, had excessive backlash at low power settings, but this was a feature of this particular airframe. A moderate amount of inertia had to be overcome to put the aircraft into a turn, but tight turns could easily be made with either brake or engine.

For my first take-off we set the trims neutral, booster pumps on, gills open and applied intermediate flap. I was told to raise the tail and fly off at about 60kt. In the event, I released the brakes at about climbing power and needed a very heavy push to lift the tail. Take-off power was 3,200 r.p.m. and +8lb boost. I counteracted a gentle swing caused by crosswind with ample movements of the light rudders. No sooner had the tail settled up than the Twin Pioneer lifted gently off and we sailed upwards at an impressive rate—about 1,000ft/min. Retraction of flap took some seconds and caused only a slight trim change and we climbed straight up to about 5,000ft with 3,000 r.p.m. and 6½lb boost. I noticed during the climb that longitudinal stability was marginally positive at the climbing speed of just over 80kt and that lateral stability was effectively neutral. Rudder caused first a yaw and then progressive bank. Slight left rudder trim was comfortable at climbing power, but not absolutely necessary.

I got the impression that the Twin Pioneer was rather soggy and sometimes very heavy to handle, but willing to go where it was pushed. When we levelled off, the speed rose to 100kt and power was reduced to 2,450 r.p.m. and 0lb boost. Power reduction caused a greater trim change than increased speed, but all could be taken out immediately with the high-geared and precise trimmers. At no time did I use the full trim travel. A sharp little trim change announced the closing of the gills. Cruising along I noticed that we were apparently steady and comfortable, but that the aircraft tended to go into a turn and the wings had to be held level. The rate of roll of about 10°/sec was not exciting, but adequate.

Three years ago, during the Paris Air Show, I rode from Le Bourget to Issy-les-Moulineaux in an earlier Twin Pioneer and noticed then that the aircraft had a remarkably steady and solid feel, like that of the Dakota, and inspired tremendous confidence in passengers. It was then operating in direct competition with helicopters; and it can still beat the large helicopter to all but the nearly impossible landing grounds.

Most important feature to try with this new variant was its single-engined performance and I therefore proceeded very soon to try the stalls and low-speed handling. At 5,000ft and cruising speed I throttled back and the speed fell off slowly. A powerful tug on the wheel was required to hold level flight. Finally, when the stick was hard back, the aircraft seemed to protest by rocking laterally and juddering before, at 75kt, mushing away and tending to drop a wing. I let the nose down and recovered without power, though some power would have lifted us out of the ensuing gentle dive much more quickly. With intermediate flap the result was about the same, but the stall came at 65kt. Again, a very hard pull back was needed to hold the nose up. With full flap the stall was again virtually the same but the speed was 58kt. In all cases, aileron control remained till the end.

I then applied about −4lb boost at 60kt. The stick went back to centre and the aircraft completely changed. It became delightful to handle, with full control and a great sense of security. With approach power we went downhill at about 400ft/min in the landing attitude, all ready for a touch-down. With power on the Twin Pioneer certainly revealed an entirely new character and a very attractive one at that. It is indeed the correct technique to make an approach for a very short landing at about 55kt. The power-on stall came at about 50kt and was without a fall-away in any direction. At 60kt, with full flap, I applied cruising power and had to heave the stick forward to hold the nose down. I now made what could have been a serious mistake by raising flap at 60kt, when the clean stalling speed was 75kt. In the event the aircraft took it like a lamb and nothing happened.

After this series of stalls we had come down to 4,700ft and I decided to cut one engine at climbing power (3,000 r.p.m. and +4½lb boost at that height) at the climbing speed of 80kt. Trow feathered the port propeller suddenly. There was a slight twitch to the left and 1½ divisions of rudder trim and a tweak of tail-down trim left me hands-off with an 80ft/min indicated climb. This was absolutely straightforward. I reduced gradually to the clean stalling speed and got well into the buffet without losing any control—again quite straightforward. The single-engined docility of earlier Twin Pioneers was one of their great safety factors, even though their single-engined performance did not reach Group A standards. Best single-engined climbing speed, clean, is 82kt and VMC for half and full flap are respectively 68kt and 64kt. I next determined to simulate, at a safe height, an engine cut at full power at 65kt with full flap—equivalent to a cut immediately after unsticking from the short take-off. We would be 1kt above VMC and would have to retract half the flap and gain the best climb speed of 76kt to get away in good order. Single-engined climb at 76kt with intermediate flap is the same as at 82kt clean.

The Series 3 Twin Pioneer photographed from "Flight's" Gemini over Ardrossan, looking south towards Prestwick and Ayr

We let down to about 500ft above the sea and set up the full-power climb with gills open at 65kt. As we passed 1,000ft, Trow throttled back but did not feather the port engine. I used all three axes of control, heaved the nose down to gain speed and retracted half the flap. It looked for a moment like a horrid dive and stick forces were very heavy, but we settled at 76kt with virtually no indicated loss of height and a rate of climb of 200ft/min immediately registered on the v.s.i. Then Trow feathered the port propeller and we were quite happy, finding no trouble in gaining height and keeping straight.

I had noticed during this slightly hairy manœuvre a tendency to over-respond to elevator movements. In fact, longitudinal stability is positive and the elevator spring-loaded downwards is there to make sure of it in adverse loadings and flight cases; but during the very slow landing approaches we next tried, the Twin Pioneer did prove quite willing to depart from trimmed attitude and speed. A little anticipation was required in slightly bumpy air as we drifted down at 60kt and 400ft/min towards the runway. Firm power adjustments were also needed to make sure that we kept on going downhill, for the aircraft was only too happy to drift on without descending. But all the time I had the steadiness and docility which I had earlier remarked upon when flying with full flap and power on. Occasionally I needed full aileron deflection, but I could fly accurately.

For my first touchdown I was unwilling to throttle completely back during the round-out and we floated on and on with no inclination to touch down. Finally I cut, took the weight on the stick and we made what I thought was rather brutal contact with the runway, approximately on all three points. For the next landing I cut power in the roundout at 60kt and we touched down very much sooner, again apparently rather hard; but Trow said that it normally felt like that. Finally, he himself made a very short landing, approaching at about 55kt and leaving power on until the wheels touched the ground.

Landing in the Twin Pioneer is an acquired habit and calls for firm control and throttle movements, but one must remember that a long landing in the Twin Pioneer is only about 300yd, which is pretty impressive for a twin-engined 16-seater. A short landing is staggering, as Farnborough-goers will readily recall. The same applies to take-off. Now that the aircraft has genuine, airline-type single-engined performance there can surely be little to prevent further orders. The Alvis Leonides engines behave extremely well in the Twin Pioneer and Scottish Aviation have made several converts out of hardened Pratt & Whitney-ites, which is something of an achievement.

I may seem to have made some fairly harsh criticisms of some aspects of the Twin Pioneer's handling, but I will say that this type gives evidence of much more thorough and thoughtful development than some I have flown, and one must always make allowances for STOL types. The Twin Pioneer sometimes felt heavy, but it never felt in the least unsafe. After my 1½hr flight I would take it anywhere where we have taken our Gemini.

SCOTTISH AVIATION TWIN PIONEER SERIES 3
(Two Alvis Leonides 531/8B engines giving 640h.p. each)
Span, 76ft 6in; length, 45ft 3in; basic weight, 10,062lb; maximum take-off and landing weight, 14,600lb; maximum payload, 19 passengers or 4,000lb freight; cabin volume, 730 cu ft; freight compartment volume, 99 cu ft. **Performance:** Speed at max continuous power at 2,500ft, 158 m.p.h.; speed at max weak-mixture power at 5,000ft, 134 m.p.h.; two-engined climb, flaps at intermediate setting, 1,250ft/min; two-engined ceiling at gross weight, 21,250ft; ceiling at gross weight with one engine at max continuous power, 7,500ft; take-off ground run, 420ft; distance to 50ft, 1,150ft; landing run, 480ft; distance from 50ft, 1,150ft; take-off field length, with full allowances, 1,525ft; maximum range, 500 n.m. with 2,550lb freight, full allowances.

AERO 145 in the Air

No 129 of the Series

I FIRST flew a Super Aero 45, with 105 h.p. Walter Minor engines, in the summer of 1957 (*Flight* for July 26, 1957) and found it tractable and efficient. During that summer Czechoslovak pilots also performed aerobatics in it over Britain, sometimes even on one engine. My next experience of the type was during the business and touring aircraft competition at Shoreham in May, when I flew the Maitland Air Charter Super Aero entered by *Flight*. Maitlands bent over backwards to make the aircraft both pretty and competition-worthy, even to the extent of respraying it in eye-catching black and yellow. But luck was not with us in the preparatory stages and I actually flew the aircraft for only about an hour before the competition itself, half an hour below a very low cloud base and the other half-hour actually in cloud from 75ft off the runway. Weather more or less wrecked the competition, but I came tenth overall and third of the four twins present. If the cross-country had been flown the Super Aero's remarkable economy and high cruising speed would have gained it an excellent place. With more practice I could also have bettered my take-off performance, but I could only make one measured take-off, about an hour before the "earnest" one, with an unknown loading.

In the event, I had to overestimate my take-off distance requirement in order to be sure of clearing the 10ft-high rope and at least not being disqualified. I made it with the utmost comfort in 300yd and could probably have used 250yd or even a little less.

If the take-off was an unknown quantity, the landing was, on the face of it, even worse. During my earlier air-test report I had recorded that the tail was a little difficult to get down for a three-point landing. Before the competition I was told that a three-pointer was impossible. I could not see that I could succeed in doing one when anyone else had tried and failed. It was also said that the proper approach speed was 90 m.p.h., but I managed to cross the hedge at 65 and then 60 m.p.h. with full flap and heave the tail down by using every bit of elevator. For the competition I flew alone with full fuel, approached at 70 m.p.h. with full flap and plenty of power, then dropped it over the line at 60 m.p.h., cutting the power about 5ft up. The landing run, with enough brake to raise the tail several times, was 171yd. On the following day I flew with full fuel and four occupants—gross weight all but a few pounds—and did not especially like the initial climb, or apparent lack of it. But at a power setting to give a consumption of about 10 gal/hr we made a comfortable 140 m.p.h. and could have flown for six hours. This feature is the Super Aero's strong point.

The aircraft was generally comfortable, a little noisy, well-equipped and pleasant enough to fly. I had no trouble making a longish instrument flight after only half an hour's limited familiarization. This machine, incidentally, is equipped with duplicated alternators, Marconi AD.722 ADF, two Standard Telephones STR.9Z 44-channel radios and British flight instruments. Until very recently it was the only foreign light twin cleared for public transport in Britain.

This all leads up to the Aero 145, latest—and last—in the long line, which I was able to test when a demonstrator reached Britain shortly after the Shoreham competition. It is substantially the same as the Super Aero, but better finished and equipped and, most important, powered by the newer Walter M-332 direct injection, supercharged engines. They give 140 h.p. with super-

(*Concluded at foot of page 17*)

The Aero 145 cockpit, with a Czech VHF radio above the throttles. Magneto and starter button groups, undercarriage controls and propeller-control buttons are on the lower left panel. Air, supercharger, trim and fuel controls are on the floor between the seats. Every electrical circuit has its own isolating switch "Flight" photographs

Far left, pilot and designer of the Skylark 3 which won the Open Class at Butzweiler, Rolf Hossinger of Buenos Aires and F. N. Slingsby of Kirbymoorside—plus Mrs Slingsby — have good reason to look pleased. Left, Standard Class champion Heinz Huth (Ka-6BR) of West Germany

BIG-LEAGUE GLIDING

3—ROLF HOSSINGER AND HEINZ HUTH NEW WORLD CHAMPIONS

By KENNETH OWEN

THE final days of the World Gliding Championships at Butzweiler Airfield, Cologne, were full of surprises. Although the Polish pilots had headed the daily points lists more often than not since the start of the contest, they had dropped with a bang on Wednesday, June 15, and the outcome was now anyone's guess. The results were to show that consistency, not brilliance, wins championships.

The task set for **Thursday, June 16,** was a 200km triangular race with turning points at Dohlemer Binz and Hummerich. The anticyclone over south-east Germany was gradually declining and a new low-pressure region was moving in from the west. Ahead of the approaching warm front was a belt of rain plus increasing high and medium cloud, the edge of which was already affecting the Butzweiler area. Rather flat cumulus was expected to develop around lunchtime, and launches would not begin before 11 a.m. because of the Corpus Christi celebrations that day.

At the launching point the photographers were out in force, concentrating on the new leaders after Wednesday's results—Goodhart, Hossinger, Huth and Juez—rather than the much-photographed Poles. Soon all the sailplanes were away, but as the cloudbase descended and the front approached it seemed most unlikely that the day's task would be completed.

ILLUSTRATED WITH "FLIGHT" PHOTOGRAPHS

If the task was not completed by at least two pilots (in a particular class), the day's points would be awarded as for distance along a straight line. Taking a calculated risk on this basis, and assuming that distance and not speed would count, a number of pilots set off directly after release without bothering to cross the starting line.

It seemed that this gamble might well succeed, for landing reports were soon coming in from along the first leg of the triangle. Among those who landed after a short distance and came back for a second launch was Anthony Deane-Drummond in the Skylark 3F. The tension mounted as we waited for news—in particular, for news of the Poles. Here at Butzweilerhof, the front had passed through quickly and the sky had cleared.

The first news of the Poles came at 3.50 in the slim form of an orange sailplane which, suddenly, was across the line, across the field and banking round to a nicely judged landing in front of us. The aircraft was the Foka; the pilot Adam Witek; and his time for the triangle 3hr 58min. The impossible had been achieved—and in a fifteen-metre Standard Class machine.

Half an hour later the Open Class Zefirs also arrived back at Butzweiler, but on the backs of their car-towed trailers. Pilots Makula and Popiel had landed on the third leg after covering an on-track distance of 166 and 163km respectively, had been quickly retrieved, and were now intent on getting into the air again for a second attempt. Within 18min trailers had been driven up to the launch point, the aircraft rigged, and Makula in No 14 was moving down the runway on take-off. Popiel followed a few minutes later, just 15min before the starting-time deadline of 5 p.m.

But serious second attempts were not feasible, and after ranging the local sky and finding nothing worthwhile the two Zefirs came in and their pilots called it a day. The distances they had achieved on their first attempts were good, but not as good, we learned later, as that of Bernhard Müller of Switzerland flying the veteran Weihe, who landed only 9km short of Butzweiler. The day's conditions had suited those aircraft having low sink rather than the high-speed machines and thus the oldest sailplane in the Open Class had beaten the newest. The announcement of Müller's

Open Class Results

(1) Hossinger (Skylark 3), Argentina, 5,102.9pts.
(2) Makula (Zefir 2), Poland, 5,079.1.
(3) Popiel (Zefir 2), Poland, 5,020.7.
(4) N. Goodhart (Olympia 419), Britain, 4,856.5.
(5) Jonsson (Zugvogel 4), Sweden, 4,443.6.
6, Ortner (Skylark 3), Argentina, 4,399.4; 7, Jensen (Ka-6), Denmark, 4,141.4; 8, Müller (Weihe), Switzerland, 4,016.5; 9, Haase (Phönix), W. Germany, 4,001.9; 10, Marchand (Breguet 901), France, 3,774.7; 11, Comte (Elfe M), Switzerland, 3,238.2; 12, Deane-Drummond (Skylark 3F), Britain, 3,184.7; 13, Bar (Zugvogel 3), Israel, 3,184; 14, Gaze (Skylark 3B), Australia, 3,074.5; 15, Johnson (RHJ-6), USA, 2,992.9.
16, Schreder (Airmate HP-8), USA, 2,891.4; 17, Tandefelt (Ka-6BR), Finland, 2,881.4; 18, Mrak (Meteor 60), Yugoslavia, 2,555.9; 19, Ferrari (Skylark 3B), Italy, 1,825.8; 20, van Bree (Skylark 3), Holland, 1,669.3.

Standard Class Results

(1) Huth (Ka-6BR), W. Germany, 5,619.1pts.
(2) Münch (Ka-6B), Brazil, 5,237.8.
(3) Witek (Foka), Poland, 5,201.9.
(4) Sejstrup (Ka-6BR), Denmark, 5,001.8.
(5) Juez (Ka-6), Spain, 4,843.7.
6, Toutenhofd (Ka-6), Holland, 4,474.2; 7, Resch (Standard Austria), Austria, 3,998.1; 8, Silva (M-100S), Italy, 3,989.3; 9, Fritz (Standard Austria), Austria, 3,907.6; 10, Harrold (Ka-6), S. Rhodesia, 3,869.9; 11, Rautio (Pik-3C), Finland, 3,787.2; 12, Bikle (SGS1-23H), USA, 3,701.1; 13, Ara (Ka-6), Spain, 3,699.4; 14, Andreae (Ka-6), Holland, 3,655.9; 15, Xhaet (Mucha Standart), Belgium, 3,410.6.
16, Jalkanen (Pik-3C), Finland, 3,402.5; 17, Junqueira (Ka-6B), Brazil, 3,396.4; 18, Johannessen (Olympia 401), Norway, 3,263; 19, Lacheny (Fauvette), France, 3,254.6; 20, Rowe (Ka-6BR), Australia, 3,229.2; 21, Brigliadori (E/C 39), Italy, 3,141.3; 22, Persson (Zugvogel 4A), Sweden, 3,051.3; 23, Doutreloux (Ka-6B), Belgium, 2,958.8; 24, A. Goodhart (Skylark 2), Britain, 2,843.6 (807pts forfeited for infringement of rule against cloud flying); 25, Arber (Ka-6), Israel, 2,818.
26, Silesmo (Ka-6BR), Sweden, 2,811.8; 27, Oda (Ka-6), Japan, 2,717.2; 28, Filipusson (Ka-6), Iceland, 2,709.1; 29, Barbera (Fauvette), France, 2,588.5; 30, Böttcher (Ka-6BR), W. Germany, 2,562.9; 31, Grundisch (Fauvette), Switzerland, 2,532.9; 32, Arteman (Fauvette), Argentina, 2,444; 33, Friis (Mucha Standart), Denmark, 1,926.6; 34, Jardeny (Skylark 2), Israel, 1,909.8; 35, Backe-Mathisen (Zugvogel 4), Norway, 1,043.7.

Posn	Contest days					
	1	2	3	4	5	6
Open						
1	Makula	Makula	Jensen, Haase	Makula	Goodhart	Müller
2	Popiel	Popiel	Marchand, Mrak,	Popiel	**Hossinger**	Makula
3	Schreder	**Hossinger**	Makula, Goodhart,	Schreder	Ortner	Popiel
4	**Hossinger**	Goodhart	Popiel, Johnson	Johnson	van Bree	**Hossinger**
5	Deane-Drummond	Marchand		Haase	Jonsson	Jensen
Standard						
1	Fritz	Witek	Xhaet, Junqueira,	Witek	**Huth**	Witek
2	Witek	Resch	Münch, **Huth,**	**Huth**	Sejstrup	Münch
3	Juez	Münch	Lacheny, Witek,	Andreae	Bikle	**Huth**
4	Resch	Ara	Andreae, Fritz,	Resch	Rautio	Sejstrup
5	**Huth**	**Huth**	Toutenhofd	Fritz	Münch	Toutenhofd

Final positions and marks of all competitors in the 1960 World Gliding Championships are given in the above lists. The Dutch pilot van Bree replaced Seyffert after the first three contest days. Five out of the first six Standard Class places were taken by Schleicher Ka-6 aircraft.

The analysis of leading pilots in each class over the contest period (left) illustrates how highly placed the Polish pilots Makula, Popiel and Witek were on every day except the fifth. On the third day all the 17 pilots listed received 1,000pts, i.e. were placed equal first. Huth was the only pilot to be among the top five on every single contest day.

1,000pts at briefing the following morning was greeted by enthusiastic applause from all other pilots and teams.

While no Open Class aircraft was able to complete the triangle, the supposedly inferior 15-metre types in the Standard Class had a more successful day. Two in addition to Witek's Foka managed to get home, but only after considerably longer flights during which they had circled for several hours waiting for the front to pass through. The pilots were George Münch of Brazil in a Ka-6B, who took 5hr 59min, and Huth in his Ka-6BR, whose time was 6hr 25min.

The only other pilots to exceed 100km were Hossinger (152km), Jensen (142km) and Comte (112km) in the Open Class; and Sejstrup (166km), Toutenhofd (163km) and Juez (134km) in the Standard Class.

The weather situation on **Friday, June 17,** was described by the contest meteorologist, Dr Gerhard Kant, as "the most difficult we have had during the whole championships." In spite of this, pilots were set the task of flying twice around a 100km triangle with turning points at Droverheide and Holzweiler. Few managed to do more than local-area flying, however (Makula, even, with his Zefir fitted with thermal detectors at the wingtips, was unsuccessful), and no marks were awarded.

This, then, was the end of the championships, with the points totals after Thursday's flying remaining as the final marks (see results opposite). That Rolf Hossinger of Argentina, flying a four-year-old Slingsby Skylark 3, was Open Class champion came frankly as a surprise—not least to the young Swedish-Argentinian himself. This was his second world contest, and the sailplane was the club-owned Skylark in which he made the notable 166-mile flight (including a 40-mile crossing of the River Plate) from Buenos Aires in Argentina to Montevideo in Uruguay in November 1958.

By profession an Aero Commander pilot with Shell Argentina Ltd, Hossinger learned to glide in 1945 and is a member of the Albatross Gliding Club based at Merlo Airfield, Buenos Aires. The weather at Butzweiler had suited the Skylark, he modestly suggested, and "A pilot has to know his aircraft pretty good to fly well, eh?"

In the Standard Class the main contenders throughout had been Adam Witek and Heinz Huth. The German pilot's victory over the former champion followed an unbeaten record of consistently good flying throughout the meeting—Huth alone was among the top five on every single contest day (see table). His job is that of air traffic controller at Hamburg Airport, while in his spare time he is chief flying instructor to the gliding section of Hamburg Aero Club. Huth's Schleicher Ka-6BR Rhönsegler *Alte Liebe*, one of two at the championships to be fitted with an all-flying tail, is normally operated by the Hamburg club.

Awards to the top three prizewinners in each class were made at the closing ceremony on the afternoon of **Saturday, June 18.** A nice touch on this occasion was the presence of Hossinger's Skylark and Huth's Rhönsegler on either side of the winners' rostrum. Behind the rostrum was a Standard Austria, indicating that this sailplane had won for its designer, Rudiger Kunz, the 1960 OSTIV Trophy.

Other prizes were presented at a championships party that evening in the Gürzenich in Cologne. These included a special prize of a Breitling Navitimer watch—a formidable instrument indicating everything but the course to fly to the next thermal—to Nicholas Goodhart. Apart from the customary excess of speeches this function was excellently organized. One could hardly say the same for the championships themselves.

The Championships Reviewed. The three main problems which the German Aero Club organizers either failed to face or mishandled were those of task-setting, cloud-flying and interpretation of the rules. Not even the charm and humour of Dr Frowein at the morning briefings could disguise this. It is only fair to add that on the flying side the organization was good: briefings were clear, launching procedure was sensible and the actual launches were efficient.

Task-setting is a skilled art in which a great margin for opinion and argument remains, but there are certain basic principles which ought to apply. In a good world-championship contest one does not set free distance on a day in which attainable distance is limited by a national frontier and not by pilot skill, resulting in 17 pilots receiving top marks. One does not set what might be described as a Lasham League 2 task on a sparkling day, resulting in 50 sailplanes sitting on an airfield 100 miles from base just after lunchtime. But on June 8 and 14 the German Aero Club at Butzweiler did just this.

These examples of over-easy tasks in good weather can be matched by illustrations of impossibly difficult ones in bad conditions, such as the 100km triangles set on June 5 and 17 and (on the final ruling) the set-line distance of June 11. Good task-setting—the outstanding example remains that of St Yan in 1956—can remove a major reason for post-contest argument. As it is, one can claim that, had the tasks been different, the final results would have been different. And one can state as fact that the task-setting at Butzweiler could have been a lot better than it was.

As mentioned in the first instalment (June 17) of this report, the cloud-flying situation was ambiguous in the early days of the championships, and only when pressed did the organizers give a ruling on the subject. Having stated that cloud-flying was prohibited, they then were faced with the problem of enforcing this rule. To complicate matters further, cloud-flying was permitted

Right, quick de-rig of Anthony Goodhart's Skylark 2 after landing in a potato field near Cologne on June 17. The car driver seems indifferent to the scene

Below, more-leisurely rig of René Comte's Elfe M early one morning at Butzweiler. This pilot was placed eleventh in the Open Class

After landing part-way around the 200km triangle on June 16, the Polish Zefirs were retrieved smartly for a second attempt. This sequence shows (top left) Makula's Zefir being taken from its trailer at the launch point; (top right) in mid-rig, with Popiel's No 15 in the background; (bottom left) Makula folds his tail parachute, and (bottom right) fits it in place. Time from arrival to take-off was 18min

Championship personalities: (left to right) chief organizer Seff Kunz; Polish pilot Adam Witek (1958 Standard Class champion) is congratulated by his wife after completing the 200km triangle on June 16; meteorological trio comprising Dr Gerhard Kant (championships forecaster), Norbert Gerbier (France) and C. E. Wallington (Britain); US pilot Richard Johnson with 1958 Open Class champion Ernst Günter Haase

Variety in American tails is demonstrated by Airmate HP-8 (Schreder, foreground) and RHJ-6 (Johnson). On far side of runway is Müller's Weihe, oldest aircraft in the contest

BIG-LEAGUE GLIDING . . .

over certain areas during the second-week tasks—which ruled out any question of barograph evidence being accepted, since the barograph trace could not be related to the track followed.

This problem was obviously not of the organizers' own making, since the large number of controlled airspaces over Germany—and, indeed, the law of the land—would have made the contest a tricky one under the best of circumstances. But the problem was of their own handling, and it was this handling that was much criticized. On the day on which Anthony Goodhart's points were discounted for an obvious cloud-flying infringement, for example, a number of other pilots also ignored the VMC rules but were not penalized simply because nothing could be proved. The captain of the Dutch team, in particular, was much concerned about this following reports from his pilots, and seriously considered making an official protest in the final days of the contest.

The dispute concerning the interpretation of Rule 10.1 of the special regulations could have been avoided by careful drafting beforehand. This rule states that, for free distance or distance along a fixed course, "at least two pilots, in each class, must fly farther than a minimum distance of 50km in order that the task may count as a contest day."

For a set-course-distance task, did the rule really mean "distance," or did it mean "projected distance" or "marking distance"? On the answer to this question depended 1,000pts for Nicholas Goodhart on June 11. The decision to reverse the original ruling, and make June 11 a no-contest day, was hardly unanimous. Of the 23 team captains forming the international jury, 12 voted for, eight against, one abstained and two were not present at the meeting.

But, in spite of the controversies on the ground, the championships had produced skill and excitement in the air. The main lesson to be learned, perhaps, was simply that it was impossible to predict results in advance. A second lesson, which is evident at each world championship, is that a leading pilot cannot afford to make a mistake on even one day.

Had weather conditions been strong throughout the contest period it would have been impossible for the Polish pilots not to have gained first and second places in the Open Class and first place in the Standard Class, such was the efficiency of their Zefir and Foka sailplanes and the well-practised skill of Makula, Popiel and Witek. These aircraft are the kind that break world records for speed and distance, and the only flaw in the case for entering record-breakers in world championships is that, usually, there is at least one poor-weather day per contest on which these aircraft fall down badly.

At Butzweiler this year that day was June 15, the fifth contest day. The 300km triangle was completed by the Olympia 419 and two Ka-6s, while the Zefirs and Foka made only 127km. This meant only 250 points compared with the leaders' 1,000, and we knew that nobody could lose 750pts on one day and still win a world championship. Although Hossinger was not among the top five on two of the days, his loss of points was relatively modest.

That pilot skill can count more than aircraft performance was well illustrated again this year, with both world champions flying club-owned "cooking" sailplanes and the best Open Class flight on June 16 being made by Bernhard Müller's Weihe—a 22-year-old design. On the other hand, the 1958 champion Haase was not able to settle-in well this year with the new Phönix.

But the most significant aspect of the results was the superiority on a number of days of the supposedly inferior 15-metre sailplanes of the Standard Class. This led pilots to question the wisdom of having two separate classes, each separately marked. Why not, for example, award marks in one complete category for all aircraft entered, thus deciding a single world champion—who might or might not be flying a 15-metre sailplane?

These thoughts we took with us as we left Butzweiler and headed home. Behind us we left the Belgian Air Force and its armed guards to return to normal at the airfield, which its Pipers share with the local flying club. We said farewell to RAF Butzweilerhof, just down the road, whose mess had extended a warm hospitality to the British team on many occasions during the championships.

We would remember the tall forest of radio masts which formed a unique skyline to the airfield; the silhouette of the Dom in the distance; and the nerve-shattering noise of cars on the perimeter p.s.p. track. The long distances involved between the various facilities on the airfield and the living quarters, and the vintage bicycle purchased for 20DM which solved that problem for one British journalist. In spite of everything, we had enjoyed our 1960 taste of big-league gliding.

Beginning and end of a championship: left, the "Musik band" which opened proceedings on June 4; right, champions on the rostrum at the closing ceremony two weeks later. Hossinger (left) is flanked by Makula and Popiel; Huth by Münch and Witek

Inside the Il-18

"Flight" presents, for the first time in any aviation journal, a detailed technical description of a modern Russian transport aircraft: it is based on data officially provided in Moscow

OF all the turbine-powered transports produced by the Soviet aircraft industry none is more attractive and interesting than the Il-18, Ilyushin's counterpart to the Vanguard and Electra. It displays none of the anachronisms that have made its contemporaries appear strange to western eyes. There are no heavy string-mesh luggage racks, porcelain figures in glass cases, lace antimacassars or hand-painted country scenes on the cupboard doors in the galley. Even the usual glazed "bomber" nose is replaced by a housing for weather radar.

It has always been assumed that this so-called westernization resulted from Aeroflot's plan to use the Il-18 on international routes, where it would have to bear comparison in every way with foreign-built airliners. Whether or not this is true, Avtoexport, Russia's aviation marketing organization, has been quick to realize that the result not only looks good but is highly competitive with other aircraft in its class in terms of performance and economic potential; and now the Il-18 has become the first Soviet turbine-powered transport to be advertised for sale in the aviation Press of Western Europe and the Far East.

The outcome of this sales drive cannot yet be assessed. The idea of buying transport aircraft from the Soviet Union is new and the Il-18 is perhaps the first type to conform entirely to current Western concepts of engine-out performance and fail-safe structures. But sales within the Communist *entente* are already promising, and this year will see the type operating on a major scale in the insignia of Aeroflot, China's CAAC, Czechoslovakia's CSA, East Germany's Interflug, Poland's LOT and Hungary's Malev.

Development and Record Flying Like most Soviet aircraft, the Il-18 progressed fairly quickly from first flight to scheduled service. The prototype (SSSR-L5811, with four 4,000 e.h.p. Kuznetsov NK-4 turboprops) was flown for the first time by Vladimir Kokkinaki in mid-1957. It had completed only three test flights when it was exhibited at Vnukovo Airport, Moscow, on July 10 of that year, but production was already under way in a factory bordering the airport.

The first 20 airframes were powered alternately by the NK-4 and the Ivchenko AI-20 of similar power; but the latter is now standard. Development appears to have gone smoothly, for comparison of photographs of SSSR-L5811 with production airframes reveals no changes on the scale of the auxiliary fins and down-swept wing-tips introduced during the pre-service phase of its Antonov equivalent, the An-10.

Earliest international recognition achieved by the Il-18 was the award of a gold medal at the Brussels Exhibition of 1958. By then the aircraft had already begun to show its possibilities, with a flight of 10,662 miles from Moscow, via Irkutsk, Petropavlovsk-Kamchatskii, the "North Pole 6" drifting station, Tiksi and back to Moscow in 27hr 30min, at an average speed of 388 m.p.h., on March 21-22, 1958.

Eight months later came the first of the exploits which earned the Il-18 almost all worthwhile FAI-recognized records for speed and altitude with payload in the propeller-driven category. On November 11-15, 1958, it lifted loads of 15 tonnes (33,070lb) to 40,915ft, 10 tonnes (22,046lb) to 43,156ft, and five tonnes (11,023lb) to 43,550ft.

On August 19, 1959, an Il-18 carried 15 tonnes over a 2,000km (1,243-mile) closed circuit at 447.07 m.p.h., which gained it five more records. On November 25 that same year it lifted 20 tonnes to 39,370ft; and on February 2, 1960, it carried a 10-tonne payload over a 5,000km (3,107-mile) circuit at 430.5 m.p.h., to add another five records to the list.

Kokkinaki was the pilot on each occasion, so it was hardly surprising to see his name linked recently with that of Sergei Ilyushin and nine others as joint recipients of a Lenin Prize in Science and Technology for developing the Il-18.

Meanwhile, after a period of experimental services in the Ukraine, carrying freight and mail, the type had entered scheduled passenger service with Aeroflot on April 20, 1959. Initially it was used between Moscow and such major points as Adler and Alma Ata. Services to Leningrad, Sverdlovsk, Baku and Tashkent followed, and during the year the aircraft began to be seen increasingly at foreign airports throughout the world.

On July 12, 1959, an Il-18 covered the 2,050 miles from Moscow to Baghdad non-stop in 5½hr. On September 13 another made a 5,400-mile Moscow - Washington trip in 13hr 56min, at an average speed of 385 m.p.h., stopping only at Keflavik *en route*. On November 17 it flew 7,250 miles from Moscow to Mexico in 21hr 5min, with only two stops, at Keflavik and Halifax.

In everyday airline service the Il-18 cruises at 388-404 m.p.h., offers a maximum stage length of over 3,100 miles with reserves, and will carry a payload of 30,865lb over ranges up to 1,550 miles. When passenger traffic is small, the load factor can be maintained by carrying up to 17,640lb of freight in three large holds, two of which are fully pressurized and air-conditioned.

Avtoexport claim that "the useful load to gross weight ratio is as high as 46 per cent, . . . achieved by utilizing the best possible layout for this category of passenger aircraft, a number of new materials and improved design techniques." It is extremely satisfactory to be able, at last, to analyse technical features of a Soviet airliner in order to decide how well this sort of claim is justified.

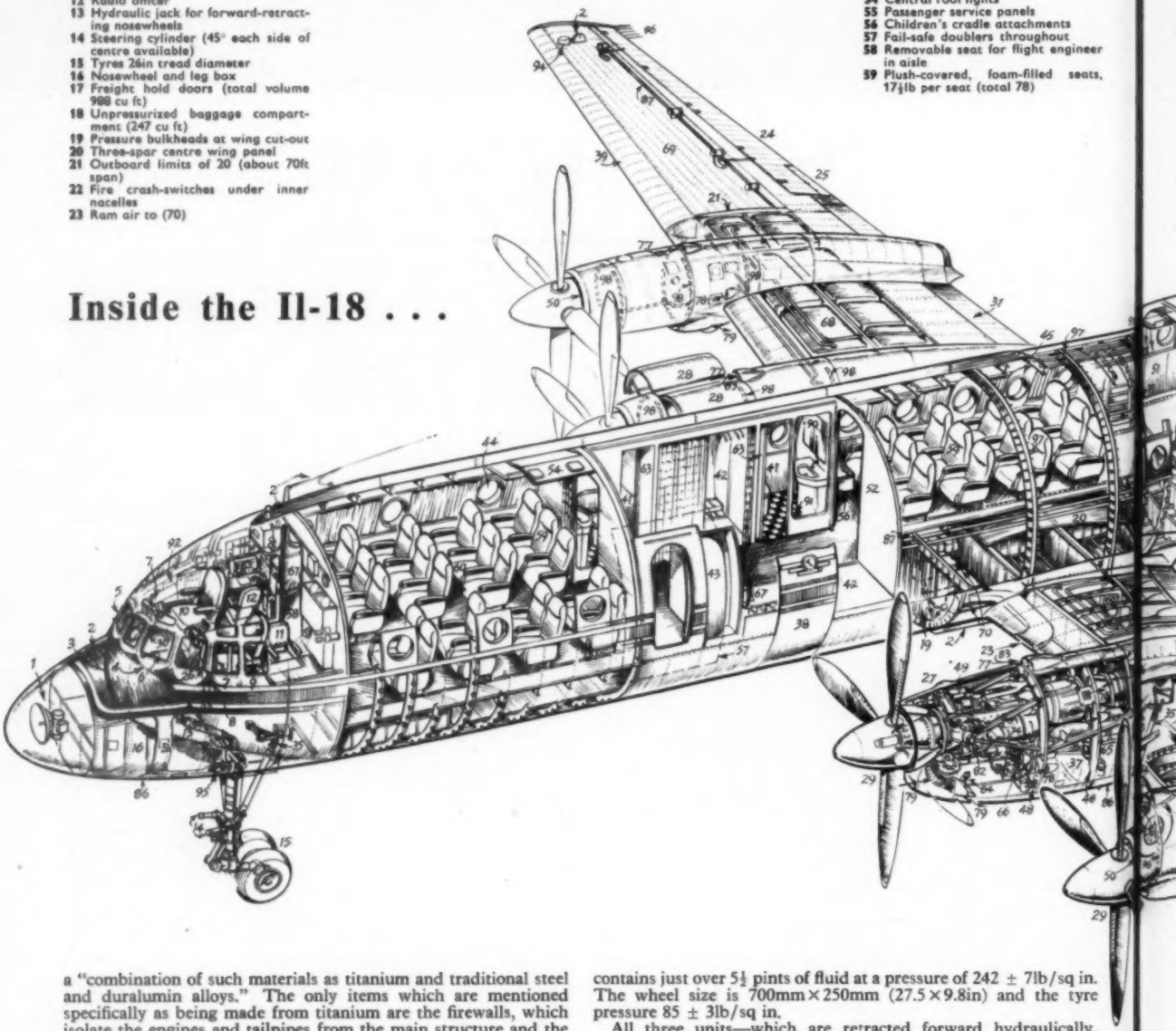
The Airframe Basically the Il-18 is a conventional all-metal low-wing monoplane with a tricycle undercarriage. The fuselage is a lightweight semi-monocoque structure of circular section and 11ft 6in diameter, with the main frames apparently spaced some 21in apart and the longitudinal stringers about 7in apart. The fail-safe philosophy has been employed fully for the first time in a Soviet aircraft, and the makers state that "all the vital areas of the fuselage have duplicated structural members, providing the so-called double-path strength." These areas include window cut-outs, door frames and the more-heavily loaded panels of the fuselage skin; and the description implies a technique similar to the titanium rip-stop doublers used on the DC-8 to reinforce the skin at the most important frames and to surround every door and window.

The wings are conventional, with a three-spar centre-section spanning 71ft 10½in, which takes it to a point some 6ft beyond each outboard engine nacelle, and with two-spar outer wings. All the space between the spars, except under the fuselage and in the undercarriage wheel-bays, is devoted to fuel tankage; but only the outer wings form integral tanks.

Automation is said to be used extensively in the production of Il-18 components, with all basic operations fully mechanized. The fuselage, wings, engine nacelles, tailplane and fin are assembled from prefabricated panels, each consisting of "a shaped skin sheet with structural elements press-riveted in place to save labour and improve the quality of the joints." The materials used are given as

1 Weather radar under dielectric nosecap
2 Aerials
3 Front pressure shell and floor
4 Skin intersection, pressure cabin/nose cone
5 Single silicate-glass windscreen panels, electrically heated
6 Hydraulic windscreen wipers
7 Control column
8 Nosewheel steering wheel (captain only)
9 Captain
10 First officer
11 Navigator
12 Radio officer
13 Hydraulic jack for forward-retracting nosewheels
14 Steering cylinder (45° each side of centre available)
15 Tyres 26in tread diameter
16 Nosewheel and leg box
17 Freight hold doors (total volume 988 cu ft)
18 Unpressurized baggage compartment (247 cu ft)
19 Pressure bulkheads at wing cut-out
20 Three-spar centre wing panel
21 Outboard limits of 20 (about 70ft span)
22 Fire crash-switches under inner nacelles
23 Ram air to (70)
24 Mass-balanced and aerodynamically compensated surfaces
25 Spring-loaded tabs
26 Direct vision panel (open)
27 Kuznetsov NK-4 turboprops: 4,000 e.h.p.
28 Hinged side cowlings
29 Auto feathering, reversible propellers with built-in anti-windmilling lock
30 Radar scope at top of instrument panel (scope can be swung aside for use by either pilot)
31 Area-increasing flaps
32 Jet pipes over wing
33 Hydraulic jack for forward-retracting mainwheels
34 Jack folds wheel-beam against leg before retraction
35 Drag-brace and up-lock
36 Sway braces with nacelle doors
37 Bogie bay under firewall
38 Ice-protection strip
39 Electro-thermal de-icing (four phases)
40 Tail bumper
41 Toilets
42 Wardrobes
43 Doors (pull-in and slide)
44 16in windows
45 Four emergency exits
46 Buffet/galley
47 Mainwheel tyres 33in tread diameter
48 Titanium fire-walls
49 Auxiliaries gearbox (two starter/generators and hydraulic pump)
50 Thin-lipped engine air intake, with 10th-stage bleed air deicing
51 Laminated plastic veneer below windows
52 "Pavinol" fireproof plastic trim
53 Continuous baggage racks
54 Central roof lights
55 Passenger service panels
56 Children's cradle attachments
57 Fail-safe doublers throughout
58 Removable seat for flight engineer in aisle
59 Plush-covered, foam-filled seats, 17½lb per seat (total 78)

Inside the Il-18 . . .



a "combination of such materials as titanium and traditional steel and duralumin alloys." The only items which are mentioned specifically as being made from titanium are the firewalls, which isolate the engines and tailpipes from the main structure and the wheel-bays.

In accordance with Aeroflot's preference for uncomplicated mechanical flying-control systems, all control surfaces on the Il-18 are operated through Duralumin-type push-pull tubes, without any form of power assistance. Stick and pedal forces are low, because the ailerons, rudder and elevators are aerodynamically balanced and are fitted with trim-tabs, plus a spring tab in the rudder. A one-piece single-slotted flap is fitted to each wing inboard of the aileron.

Each main undercarriage unit comprises a high-absorption shock-strut carrying a four-wheel bogie. The shock-absorber contains just over 19½ pints of fluid at a pressure of 683 ± 14lb/sq in. The wheels are 930mm × 305mm (36.6 × 12in), with tyres inflated to 114 ± 3lb/sq in.

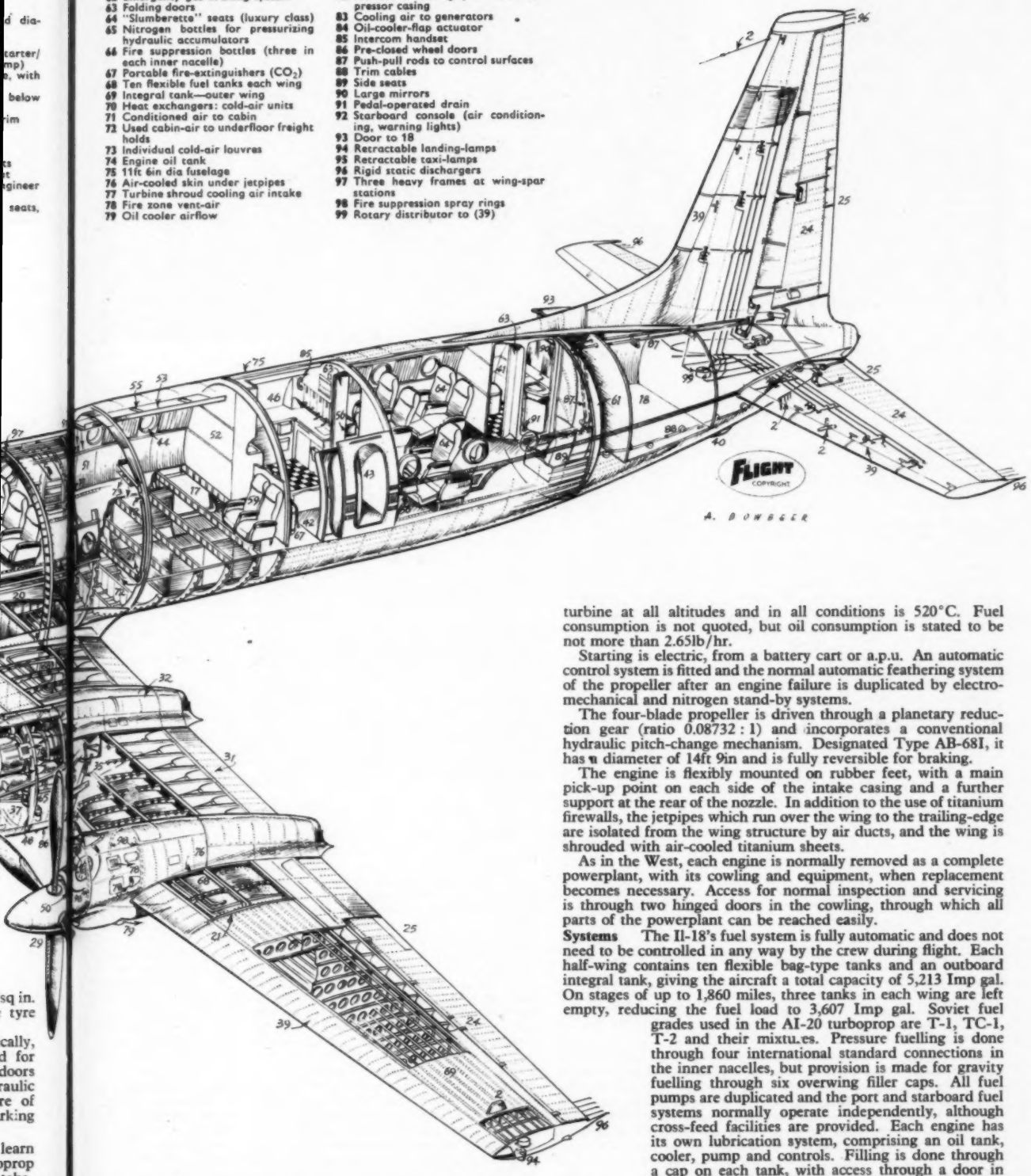
The oleo-pneumatic shock-absorber of the twin-wheel nose unit contains just over 5½ pints of fluid at a pressure of 242 ± 7lb/sq in. The wheel size is 700mm × 250mm (27.5 × 9.8in) and the tyre pressure 85 ± 3lb/sq in.

All three units—which are retracted forward hydraulically, under control of an electric selector switch—are designed for free-fall operation in emergency. To reduce drag, the wheel doors remain closed while the undercarriage is locked down. Hydraulic brakes on the main wheels operate at a normal pressure of 925lb/sq in, an emergency pressure of 1,065lb/sq in and a parking pressure of 710lb/sq in.

Powerplant One of the surprises of the Il-18 has been to learn how closely its 4,000 e.h.p. Ivchenko AI-20 single-spool turboprop engines match the configuration of the Napier Eland, with intake-mounted reduction gear, ten-stage axial compressor, and three-stage turbine. A major difference is that the Russian engine has an annular combustion chamber with ten burners.

Data available for the first time give the engine speed as 12,300 ± 90 r.p.m. for take-off and cruise, and 10,400 ± 200 r.p.m. for flight-idle. The maximum allowable gas temperature past the

60 Seat-back tables
61 Rear pressure bulkhead
62 Emergency gas braking system
63 Folding doors
64 "Slumberette" seats (luxury class)
65 Nitrogen bottles for pressurizing hydraulic accumulators
66 Fire suppression bottles (three in each inner nacelle)
67 Portable fire-extinguishers (CO_2)
68 Ten flexible fuel tanks each wing
69 Integral tank—outer wing
70 Heat exchangers: cold-air units
71 Conditioned air to cabin
72 Used cabin-air to underfloor freight holds
73 Individual cold-air louvres
74 Engine oil tank
75 11ft 6in dia fuselage
76 Air-cooled skin under jetpipes
77 Turbine shroud cooling air intake
78 Fire zone vent-air
79 Oil cooler airflow
80 Tension springs to tailpipe
81 Rear mounting spigot
82 Flexible mounting point on compressor casing
83 Cooling air to generators
84 Oil-cooler-flap actuator
85 Intercom handset
86 Pre-closed wheel doors
87 Push-pull rods to control surfaces
88 Trim cables
89 Side seats
90 Large mirrors
91 Pedal-operated drain
92 Starboard console (air conditioning, warning lights)
93 Door to 18
94 Retractable landing-lamps
95 Retractable taxi-lamps
96 Rigid static dischargers
97 Three heavy frames at wing-spar stations
98 Fire suppression spray rings
99 Rotary distributor to (39)



In his drawing above our artist has chosen to depict the Il-18 in the mixed-class 73-84 passenger configuration; 78 seats are actually shown, there being 14 rows of three-and-two and four double seats at the rear. In some other versions a slightly different window and door arrangement may be noted

turbine at all altitudes and in all conditions is 520°C. Fuel consumption is not quoted, but oil consumption is stated to be not more than 2.65lb/hr.

Starting is electric, from a battery cart or a.p.u. An automatic control system is fitted and the normal automatic feathering system of the propeller after an engine failure is duplicated by electro-mechanical and nitrogen stand-by systems.

The four-blade propeller is driven through a planetary reduction gear (ratio 0.08732 : 1) and incorporates a conventional hydraulic pitch-change mechanism. Designated Type AB-68I, it has a diameter of 14ft 9in and is fully reversible for braking.

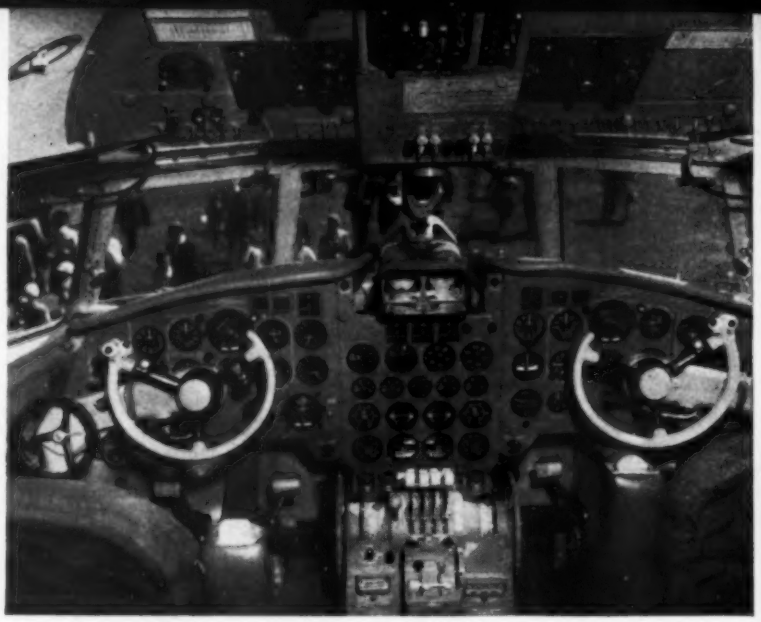
The engine is flexibly mounted on rubber feet, with a main pick-up point on each side of the intake casing and a further support at the rear of the nozzle. In addition to the use of titanium firewalls, the jetpipes which run over the wing to the trailing-edge are isolated from the wing structure by air ducts, and the wing is shrouded with air-cooled titanium sheets.

As in the West, each engine is normally removed as a complete powerplant, with its cowling and equipment, when replacement becomes necessary. Access for normal inspection and servicing is through two hinged doors in the cowling, through which all parts of the powerplant can be reached easily.

Systems The Il-18's fuel system is fully automatic and does not need to be controlled in any way by the crew during flight. Each half-wing contains ten flexible bag-type tanks and an outboard integral tank, giving the aircraft a total capacity of 5,213 Imp gal. On stages of up to 1,860 miles, three tanks in each wing are left empty, reducing the fuel load to 3,607 Imp gal. Soviet fuel grades used in the AI-20 turboprop are T-1, TC-1, T-2 and their mixtures. Pressure fuelling is done through four international standard connections in the inner nacelles, but provision is made for gravity fuelling through six overwing filler caps. All fuel pumps are duplicated and the port and starboard fuel systems normally operate independently, although cross-feed facilities are provided. Each engine has its own lubrication system, comprising an oil tank, cooler, pump and controls. Filling is done through a cap on each tank, with access through a door in the cowling: drainage is through the cocks and valves on the engine, tank, feathering pump and cooler. Tank capacity is 12.85 Imp gal per engine, the grade being quoted as 75 per cent transformer oil and 25 per cent of MK-22 or MC-20.

As already noted, the hydraulic system is used to retract and extend the undercarriage, to operate the wheel brakes and to

Inside the Il-18 . . .



The neat flight-deck, the arrangement of which is described below, is finished in grey, with black panels and dials

control propeller pitch. It also provides power for nosewheel steering and for the windscreen wipers. Total fluid capacity of the system is 16.5 Imp gal, with a reservoir capacity of 10.5 Imp gal, filling being either by gravity through a filler cap on the reservoir or by pressure through connections in the nacelles, using a ground hydraulic power unit. A maximum working pressure of 2,985lb/sq in is maintained in the system by two engine-driven pumps capable of handling 8.8 Imp gal per minute.

Linked with the hydraulics is a compressed nitrogen system which is used not only to charge the hydraulic accumulators but to provide emergency braking and propeller feathering. The gas is contained in two bottles, one of 0.42 cu ft capacity for the brakes and the other of 0.10 cu ft capacity for the emergency feathering. Storage pressures are 1,850-2,135lb/sq in and 850lb/sq in respectively; and the bottles and hydraulic accumulators are charged simultaneously from a ground unit.

The Il-18 has both d.c. and a.c. electrics. The d.c. supply is from eight engine-driven generators (rated at 12kW) and from batteries, the rated voltage being 28.5 with the generators and 24 with the batteries. The single-phase a.c. current is supplied by four 8kW alternators and an inverter. Three-phase a.c. supply is from two more inverters, of which one is for emergency use.

The complete electrical system is of the ring multi-wire type, with the bus-bars arranged in a four-wire two-way system which will remain operative so long as any one source of power keeps functioning. On the ground, a.c. and d.c. current are supplied from a g.p.u. through external international standard sockets.

Availability of these powerful and reliable electric power sources has enabled the Il-18's designers to utilize an electric thermal de-icing system capable of coping with severe icing conditions with one or even two engines out. This is in line with the view expressed by Soviet delegates at the recent Napier ice-protection conference at Luton—that hot-air wing de-icing is preferable for turbojet aircraft, but that an electro-thermal system is better for turboprop transports, where hot-air bleed from the engines might lead to an excessive reduction in power.

The de-icers on the wing, tailplane and fin leading-edges have an insulated sandwich structure consisting of two metal skins with a heating element between. The wire-grid elements on each half-wing and tail surface are made in four separate sections which take their power in turn from the d.c. system.

Ten per cent of the wing chord is protected by de-icers, and 7-8 per cent of the tail-unit chord. Heat loading over the aerofoil varies from 6.5 to 9W/sq in. The switched-on period of each section is 30sec and the ratio of switch-on to switch-off time is 1 : 4. A similar system is used for the propeller blades and spinners, except that in this case the power comes from the a.c. source. The blade-heating elements cover 60 per cent of the propeller radius and 17 per cent of the blade chord. Heat loading is constant along the chord and variable along the radius, from 9.7 to 12.9W/sq in. The switching cycle is 24sec on and 24sec off.

Also heated by a.c. current are the laminated windscreen panels, which have a transparent electroconductive film between two layers of silicate glass. In this case the heat loading is 3.9W/sq in. Finally, the engine air intakes and generators are heated by hot air tapped from the last stage of the compressor.

Safety Features From what has been written so far it will be obvious that the Il-18 design team have placed great emphasis on structural and operational safety. Sufficient power is available for easy take-off on any three engines and for maintenance of height in cruising flight on two. Landing and take-off runway requirements and undercarriage design are such that emergency landings could be made at small unpaved airfields.

A feature of particular interest is that the flight deck is separated from the main cabin by a pressure bulkhead, so that a sudden decompression of one would cause no loss of pressure in the other. Another safeguard is that much of the key navigation, radio and pressurization equipment is duplicated.

The fire-extinguishing system consists of six built-in extinguishers of 10.5 Imp gal total capacity to deal with fires in the engine nacelles, plus five portable CO_2 extinguishers of 2.5 Imp gal total capacity to combat fires in the flight deck or passenger cabins. The system is so arranged that three of the built-in bottles are discharged automatically at a signal from the fire-warning devices, while the other three are under the control of the crew. Mechanical levers on the underside of the inboard nacelles are tripped to operate the system in a wheels-up landing.

Accommodation The total pressurized volume of the Il-18's fuselage is 8,475 cu ft, of which the flight deck accounts for 330 cu ft, the forward under-floor cargo hold 470 cu ft and the rear under-floor hold 483 cu ft. In addition, there is an unpressurized baggage compartment of 250 cu ft capacity to the rear of the main cabin, with a large external loading door.

There are two passenger entry doors, one fore and one aft of the wing on the port side, each measuring 4ft 7in high by 2ft 6in wide. The four emergency exits are 2ft 6in high by 1ft 6in wide.

A flight crew of four is standard, with the navigator's station facing sideways on the port side, behind the captain, and the radio operator's station facing sideways on the starboard side, behind the co-pilot. Provision is made for a removable seat for a flight engineer between the navigator and radio operator.

Layout of equipment and instruments is neat and unsophisticated. Each pilot has a blind-flying panel and comprehensive flight instruments, including a weather-radar scope and ILS indicator. Radio and electric controls are above the central panel, which carries the powerplant, hydraulic system and pressurization system instruments. Radio-compass controls, fire-extinguishing buttons and the switches for some other systems are on the roof panels.

Outboard of the captain's position is a long console carrying fuel and oil gauges, engine starting controls and some radio controls. A similar console on the starboard side carries the instruments and controls for the air-conditioning system and warning lights. Controls for the engines, undercarriage, flaps, trim-tabs and electric autopilot are mounted in the normal way on the pedestal between the pilots' seats. At the navigator's station are a chart table, control panel and vertical instrument panel carrying, among other items, ADF indicators, course indicator, automatic navigation equipment and a radar scope.

Few details are available of the types of radio and radar fitted, but they include standard communications equipment, two automatic radio-compasses, a radio altimeter, ILS, marker beacon receiver, intercom and the nose radar. This last offers all the versatility of its Western counterparts, with provision for storm and terrain warning, ground mapping and for picking up ground beacons as a navigation aid. Unspecified long-range navigation equipment is offered on versions of the Il-18 intended for service on international routes.

Turning now to the passenger accommodation, the customer is told that "the Il-18 can be delivered with any technically feasible layout of interior compartments, trimming and equipment." The most popular model is the Il-18B, which seats from 73 to 111 passengers in three separate cabins. The forward cabin in this version takes from 20 to 24 passengers; the main cabin 71 coach or 50 first-class passengers; and the rear cabin 14-16 tourists or eight passengers on luxury-class "slumberettes." Headroom throughout is 6ft 6in and maximum cabin width 10ft 7in.

All seats are mounted on rails to permit quick adjustment of pitch, and it takes from one to two hours to convert the cabins from one class to another, using six-abreast seating for coach class, five-abreast for tourist class and four-abreast for first-class.

Looking aft through the Il-18 cabin in tourist - class configuration. A wide variety of seating arrangements is possible. Headroom is 6ft 6in and maximum width 10ft 7in

Right, the toilet compartments are well up to Western standards, with h. and c., dressing-tables and electric-razor points

Special configurations include a long-range executive version with office, lounge and bedroom accommodation, and a high-density 120-seat coach model in which the pressurized cabin is extended aft to take in the space normally occupied by the unpressurized baggage hold. Soft pastel shades of silvery grey and light green are standard for the interior decor, which achieves a high degree of comfort and eye-appeal. Ceilings, walls and bulkheads are covered with fire-resistant fabric and a washable plastic known as Pavinol, which has a pleasant velvety texture. Window and doorway curtains are of a synthetic fabric.

The lightweight seats have a structure of light alloy and Porolon foam plastic and are covered with a synthetic fabric which can be removed quickly for cleaning. The back lowers through 55° to a maximum reclining position, and can be stopped at any intermediate angle. In the twin-seat units, the central arm-rest is removable to produce a small sofa. Accessories include a down-filled cushion, safety-belt, ash-tray and a table which slots into the arm-rests and stows in a pocket in the seat-back when not in use. For very young passengers, rigid lightweight cradles are attached to the inter-cabin bulkheads.

Carry-on luggage is accommodated in a continuous overhead rack, under which are panels carrying fresh-air louvres, reading lights and a stewardess call-button. The main ceiling lamps are of heat-resistant organic glass.

The standard Il-18B has two roomy wardrobes in line with the propellers, and three large toilet rooms (on each side of the starboard wardrobe and at the rear of the aft cabin). Each of these rooms has a wall-mirror over a plastic washbasin, supplies of hot and cold water, a dressing table and an electric razor point. Toilets are of the flush type, charged with a liquid chemical deodorant.

Opposite the rear passenger door is the large combined galley-pantry, complete with electrically heated ovens and water-boilers. Special metal containers have been designed to carry food, plates and glasses, and these fit into racks in the pantry.

Maximum pressure differential is 7.1lb/sq in, giving an equivalent altitude of 5,000ft when cruising at 26,000ft, and of 8,000ft at 32,800ft. Sea-level conditions are maintained up to 17,000ft to ensure passenger comfort during climb and descent.

Heated air for the system is tapped from the turboprop compressors, humidified to a moisture content of not less than 40 per cent, and supplied to the cabin at floor level at a constant temperature of 20°C. Ventilation is efficient, the entire air content of the cabin being changed every two minutes. Soundproofing, by Kapron and glass-wool, is also good.

This, then, is Russia's contender for the international medium-range airliner market. Added to the Il-18's other undoubted attractions is the fact that it is available and in service now, with the experience of well over a year of scheduled operation—apparently free of any major troubles—to weigh against the greater sales experience of Western manufacturers. If any aircraft could establish the Soviet Union as a major supplier of commercial transport aircraft on a world-wide basis, this is it.

ILYUSHIN IL-18 DATA

Dimensions and Areas: Span, 122ft 8¼in; length, 117ft 9in; height, 33ft 4in; wheel track, 29ft 6in; wheelbase, 41ft 10in; propeller clearance, 2ft 6in; wing area, 1,507 sq ft; wing chord (root), 18ft 5in; wing chord (tip), 6ft 2in; aspect ratio, 10; aileron area (each), 98.05 sq ft; aileron span (each), 21ft 8in; flap area (each), 292.23 sq ft; tailplane span, 38ft 8¼in; total area of horizontal tail surfaces, 299.13 sq ft; elevator area (each), 102.90 sq ft; total area of vertical tail surfaces, 193.00 sq ft; rudder area, 71.58 sq ft.

Weights: Max take-off weight, 135,584lb; max payload, 30,865lb; max wing loading, 89.1lb/sq ft; max power loading, 8.38lb/e.h.p.

Performance: Cruising speed at 26,000ft, 388-404 m.p.h.; max range, no reserves, 3,480 miles; take-off run, 2,625-3,940ft; landing run, 1,970-2,300ft.

AERO 145 in the air (continued from page 9)

charger and 105 h.p. without. The latest electric v.p. propellers are fitted, with improved pitch-control mechanism, and there are oil coolers. Surprisingly, the M-332s weigh the same as the Minors. The 66 gal tankage is retained.

The top canopy panels have been bulged and tinted to give more head-room and shade, and several struts have been eliminated to give a slight improvement in visibility. Catches and locks are neater and interior finish very much better than before. Engine and flight instruments are more comprehensive and the magneto controls and starters are grouped together. The former have a push-button for "both on" and separate buttons for testing mag. drop. I fail to understand the continued lack of a parking brake.

I had enjoyed flying the Super Aero and found, naturally enough, that the 145 was very much the same. But it possessed greatly improved take-off performance and, particularly, a real single-engined capability. I flew with 11 gal less than full fuel and two occupants, myself and Omnipol test pilot Vladimir Vlk (the "l" can be a vowel in Slav languages). I found the stall to be full-blooded with a deep wing drop at 65 m.p.h., with the aircraft clean and power off. With full flap and wheels down we descended power off at 1,200ft/min at 80 m.p.h. and stalled absolutely straight without dropping either wing or nose at 60 m.p.h. With a little power I was able to trim hands-off at 55 m.p.h. and manœuvre quite sharply. The rudder was a little mushy, but ailerons remained extremely crisp and were effective long after the stall. I reckoned 1.3V$_{SL}$ as 78 m.p.h., but Vlk insisted that the approach should be made at 90 m.p.h.

At 120 m.p.h. and 1,800ft I throttled back the right engine, held a slight swing and pressed the feathering button. The propeller ran for 10sec before stopping, but I trimmed out to cruise happily at between 110 and 120 m.p.h. We then applied supercharger and nominal power and climbed at 90 m.p.h. This we could have kept up all day. There was a light residual rudder load to hold, but we gained 300ft in one minute. I pulled back to 65 m.p.h., at which we began to stall, and was still flying straight with ample control. To unfeather I simply had to press the appropriate button and switch on the magnetos. One can use the starter if necessary to get the propeller windmilling.

The Aero 145 is certificated in Britain in Group C for aircraft with *en route* single-engined performance and is cleared for public transport work. It is certainly an improvement on the Super Aero in power and load, and better finish and equipment have made it a great deal smoother. The major attractions are its very low price in Britain (£11,750) and its remarkable economy. Official single-engined ceiling is 6,300ft and rate of climb is 350ft/min.

OMNIPOL AERO 145

(Two Walter M-332 engines giving 140/105 h.p. each)

Span, 40ft 4in; length, 24ft 8in; wing area, 184 sq ft; empty weight, 2,266lb; gross weight, 3,530lb. **Performance:** max speed, 174 m.p.h.; cruising speed at 3,800ft, 160 m.p.h.; stalling speed, 62 m.p.h.; climb at s.l., 860ft/min; service ceiling, 18,530ft; single-engined ceiling, 6,300ft; single-engined climb, 350ft/min; take-off run, 705ft; landing run, 754ft; range, 942 miles

Straight and Level

YOU know the old definition of a camel—"a horse designed by a committee." I wonder what sort of a supersonic airliner would come out of the Anglo-Franco-American collaboration now being considered.

It is not going to be all beer and skittles welding our own design teams together to work on a supersonic airliner. For example, Avro and D.H. are in the same group—but so were Van Gogh and Gauguin. So were Reynolds and Gainsborough. Like all artists—and aircraft design is an art as well as a science—they each had strong views on the expression of their art.

It is going to be even less easy getting the *two* British groups to work together—as they must, since obviously we can't afford to do two supersonic transports.

* * *

Can you imagine us, having got together, then sitting down at the same easel with the French—who are, if anything, an artier lot than we, and who have common market obligations to co-operate with the German, Dutch and Italian aircraft industries? And can you further imagine us, having somehow succeeded in doing that, drawing up another stool for the Americans, who don't need European help anyway and who would certainly want to mastermind the masterpiece? The result would be as inchoate as an action-painting by Jackson Pollock.

So what do we do—go it alone? Well, at any rate we have already unfurled our canvas and got started on the broad brushwork of our own design. Let's press on; if anyone wants to join in, they will be very welcome.

Passing thought: In all the recent top-level supersonic airliner discussions has anyone remembered to ask the airlines for their views?

● Six DC-8 airlines have decided to pool DC-8 spares at 25 airports around the world—KLM, PanAm, SAS, Swissair, Alitalia and Japan Air Lines.

This cost-cutting trend towards spares-pooling is most sensible. But I wonder how kindly the manufacturers take to it. They make money on spares. Production programmes are costed on the expectation of so many units sold plus, let's say, 25 per cent spares. This costing may have to be re-adjusted.

Is it any comfort to manufacturers to suggest that efforts by airlines to cut costs must eventually result in lower fares, which will expand traffic and hence increase the demand for aircraft?

Well, anyway, spares managers can at least *try* that argument on their managing directors when they are called to account for their diminished sales.

● I don't want to precipitate an argument about which nation, Britain or America, is quicker at discovering the cause of an aircraft accident. It would be rather an unseemly discussion anyway. But the record needs putting straight, in view of the following from the US journal *Airlift*:

"Lockheed's feat in pinpointing the source of the [Electra] problem in less than two months has been little short of phenomenal. The British Comet episode, which it matches in significance, required 6-8 months to find an answer."

The difference between the two Electra mid-air disintegrations and the two Comet 1 mid-air disintegrations was that the latter took place over the ocean. The recovery of the scattered pieces of Comet 1 wreckage from the bed of the sea was probably the most dauntingly difficult salvage job ever attempted.

Nevertheless, the Royal Aircraft Establishment found the cause of the accident in their test tank in June 1954, two months after the second Comet 1 tragedy on April 8, 1954. The full inquiry wasn't until October, but the cause had been established—in two months.

This is not to suggest that the Electra investigation was not "little short of phenomenal." It certainly was. But it was no more phenomenal than the Comet 1 investigation. And in any case, shouldn't *every* accident investigation be done at a speed that is little more than phenomenal?

Here's another chap I feel sorry for. His dodgem is a long way from Butlin's and he's fresh out of candy floss. He has cramp, claustrophobia and frostbite, so it's not likely that he's going to be able to get out of that thing. And even if he does he's going to find himself up to his Plimsoll line in freezing water. There's water, snow, rock and tundra as far as the eye can see, so, even if he manages to get a tow, with that rear wheel the shape it is he's going to be knocked cold. I can't imagine what he's got to wave about.*

● I hereby award the Bacon flitch for the snazziest convention, symposium, colloquium or conversazione to America's National Aeronautic Association. I quote the Association's journal: "Fred Waring and his entire orchestra will present a special 'Salute to NAA' concert on the first night of NAA's 1960 annual meeting in Indio this fall . . . The concert will be played in a beautiful $100,000 outdoor stage located on the Riverside National Date Festival Grounds. It seats 4,700 people . . . In order to take advantage of the opportunity presented by Mr Waring, the pit barbecue scheduled for the Cochran-Odlum ranch has been moved up to 5.30 p.m. on Monday . . ."

Which should give the chaps a little time off for business.

● "Don't worry—our design office is working on just that very point at this moment . . ."

Thinks: That's another snag we didn't reckon on.

ROGER BACON

The small boy, who perhaps owns a model Bloodhound, is already concentrating on the next item. His mother wears a look of classical resignation; his father studies the missile, or the RAF police, or the Alsatian. The girl and the youths seem indifferent. This might have been an unworthy Grecian frieze, with hoplites trundling past the Athenians, instead of part of the Royal Tournament procession through a leafy Hyde Park

**The technical editor tells me it's an escape capsule undergoing environmental testing to check on predicated data and dedicated crewmen.*

Studies in Design

AN ANALYSIS OF RECENT PROJECTS AT THE COLLEGE OF AERONAUTICS

IN order to provide students taking the normal Diploma Course at the College of Aeronautics at Cranfield, Beds, with experience in roughing out the basic design of an aeroplane, the Department of Aircraft Design at the College annually concocts an actual design study for students in their second year. Each project is normally the brain-child of A. F. Newell, deputy head of the department, and J. J. Spillman, senior lecturer in the Department of Aerodynamics. Powerplants may be chosen from a variety of advanced studies which are always in hand by the Department of Aircraft Propulsion, and it is usually possible to present the 2nd-year men with a fairly clear-cut basis of a design.

No project is ever anybody's full-time job; instead, four or more students work on it for about three months. After the basic configuration has been decided upon, aerodynamic, stability and control problems are settled, using suitable tunnel models, and the loading cases are worked out in detail. Such an exercise is valuable in the extreme; but the increasing complexity of modern aeroplanes has been making it progressively less easy to evolve a design which is truly authentic. The position should improve next month when the College commissions its Ferranti Pegasus digital computer, with which it will be possible to programme much greater quantities of data. In any case, even though no project is perfectly conceived, these exercises are very valuable in their detail design problems and in forward thinking generally. For these reasons we are glad to publish notes on the last half-dozen.

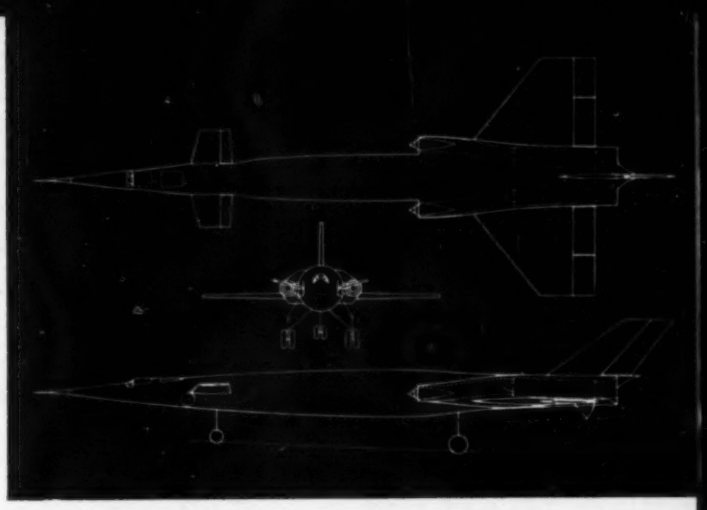
1955 *Photographic reconnaissance* High-speed reconnaissance seemed particularly important in 1955; there was at the time an official specification for such a machine, but the College did not enjoy any collusion with those working on it. It was particularly hoped that the study would unearth many of the problems of making a steel aeroplane. The 1953 project (an intercepter reminiscent of the Lightning) had been designed for manufacture largely from steel sandwich, and this form of construction was again chosen. Discussions were held with Avro, who were then busily engaged with the 720 intercepter and 730 bomber, and joint research was conducted with welding experts of the British Oxygen Company. Finally a system of puddle-welding was arrived at, and this method has been of assistance to Bristol Aircraft on the 188 programme.

It was found that the optimum aeroplane for the mission specified would have weighed between 250,000 and 300,000lb, requiring six or eight advanced Olympus or Gyron engines. In order to reduce the magnitude of the project it was decided to impose an arbitrary limit of 100,000lb. This made the design ineffectual as a PR machine (it could not have done the job) but posed the same problems of aerodynamic design and structure.

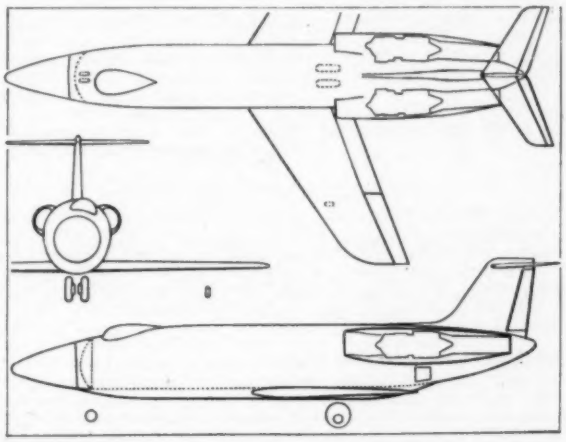
Powerplants were to be two turbojets from the Department of Propulsion, each installed with a variable-area intake, an afterburner and fully variable convergent/divergent nozzle. Using a simplified method, based on Prof Ward's slender-body theory, the aircraft was very neatly area ruled. The slab foreplane was found to confer satisfactory trim and control over the entire speed range, and by employing blowing over the flaps of the mainplane and the trimming elevators of the foreplane the stalling speed at maximum landing weight was held to 114kt. In actual practice the aircraft would not have been able to accommodate the vast aerials demanded by the mission.

1956 *Research* On this occasion the College decided to design the sort of aeroplane they would themselves most like to have. Essentially it could be regarded as a replacement for the Anson or Dove as a general-purpose machine for research, instruction and transport. The basic configuration was quite cleverly thought out and would have made the aircraft more amenable to such duties than any other aeroplane yet conceived.

It was to be capable of carrying six students and a large amount of test equipment to high altitudes at high subsonic Mach numbers. Power was to be provided by a pair of rear-mounted Bristol Siddeley Orpheus; either would have been capable of flying the aircraft alone, so that the other nacelle could have housed a test engine or a powerplant for boundary-layer control. A very clean wing would have been possible; picking up on the rear fuselage frames, and carrying no landing gear apart from small outriggers, it could carry any desired test equipment and could even be exchanged for a different pattern. For classroom purposes the whole fuselage was to be pressurized, and to facilitate the testing of all kinds of radio and radar devices the entire nose, and the skinning of the underside of the fuselage below the pressure hull, was to be of glass fibre. [*Continued overleaf*

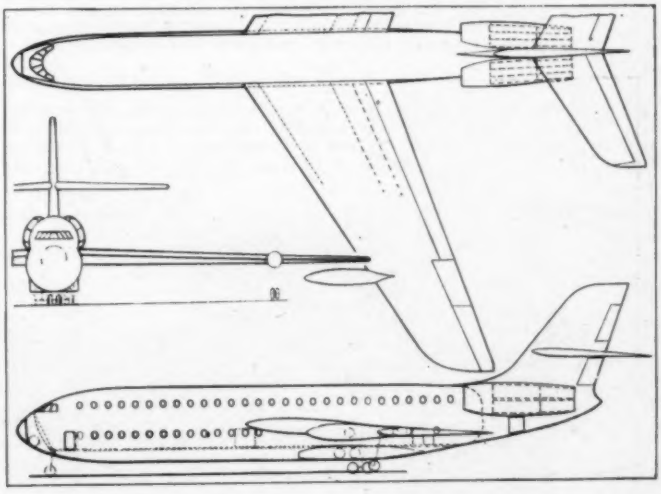


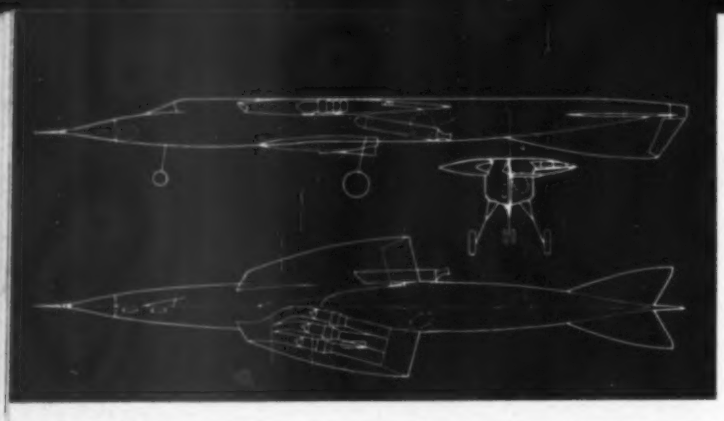
1955 reconnaissance aircraft. Two reheat turbojets. Length, 105ft 6in; max fuselage diameter, 8ft; aspect ratio (wing and foreplane), 2.5; t/c ratio (wing and foreplane), 5 per cent; leading-edge sweep (wing), 40°; gross weight, 100,000lb; wing loading, 147lb/sq ft; design cruising speed, 1,080kt (about M3.3) at 65,000ft, for 2,500 n.m. range



1956 research aircraft. Two turbojets each of about 4,500lb thrust; or any of a variety of alternative arrangements with approximately the same aggregate thrust for prime propulsion, exclusive of engines under test or used for special purposes (such as the supply of compressed air, hot gas or shaft power). Gross weight, 15,000lb; limiting Mach number 0.8 at up to 55,000ft ceiling

1957 transatlantic airliner. Four turbojets each of about 20,000lb thrust. Gross weight, 320,000lb. Aircraft designed to transport 200 passengers and 7,000lb of freight (in underfloor bays of much greater capacity, assuming typical densities) over non-stop transatlantic stages, cruising at 475kt (547 m.p.h. or M0.825)





1958 tactical strike and low-level bomber. Six turbojets, each of 2,200lb thrust, scaled from the Rolls-Royce RB.108. Gross weight, 36,000lb. Designed to fly at M1.5 at all altitudes up to 20,000ft, the primary armament comprising a 2,000lb air-to-surface missile partially internally

Fundamental to the problem is the lift-curve slope, and the wing incidence and lift coefficient when flying at supersonic speed through gusts. The only solution is to make the wing loading very high indeed, and the Cranfield study settled on 300lb/sq ft. In turn this makes the aeroplane look like an impossibly "hot" flying machine; and this is just what it is, but there are ways of making it fly with reasonable safety.

Propulsion took the form of a trio of small turbojets inside each wing. The span was so truncated that the engines extended almost from tip to tip, and the trailing edge was arranged as an almost full-span flap capable of deflecting the entire powerplant efflux downwards to almost 60° without separation. Flap sections were to be fabricated from corrugated spars and webs, and test sections of Nimonic 75 were investigated at up to 750°C without buckling.

At take-off enormous lift was obtained at full thrust with the flaps down, but with no angle of attack on the wing proper. Free take-off would have been possible, but for most operations (certainly from carriers) catapulting or solid boost motors would have been desirable. Owing to the high fuel consumption on most missions the landing weight would have been relatively low, and approach speed not excessive. It was found that the optimum configuration was to have a low aspect ratio slab tailplane and ventral fin, the wing flaps being used for roll control. Tunnel testing showed the aircraft to be unstallable, although stability and control problems were admittedly immense. Even with a tyre pressure of 300lb/sq in the rear fuselage had to be made square in section to house the retracted main gears; the pressurized forward portion was of circular section. The navigator was seated behind, and to the right of, the pilot.

1959 *Heavy freight* Last year 12 students took the project for a heavy freight aircraft to an advanced stage. Plenty of data were already on tap, and it was possible to compare notes with the teams of Barry Laight (Blackburn 107) and David Keith-Lucas (Britannic). Like both these "real" projects the F.59 was designed around four Rolls-Royce Tynes; but in some respects it could have been better than either (for example, it specifies a full-section door at both ends of a 100ft hold). Pressurized volume was some 14,000 cu ft.

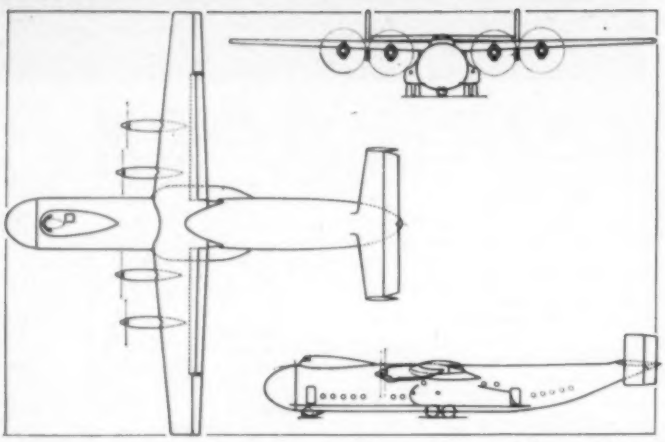
It was boldly decided to use low-pressure tyres (60lb/sq in), giving an LCN of only 28 at maximum weight for unprepared surfaces. Another courageous decision was the location of the retracted bogies entirely outside the fuselage; this improved the design of the pressure hull, obviated the need for projections into the freight space and gave a valuable increase in track, but the structural penalty was considerable. Originally the design had a single fin, but to reduce torsional moments on the rear fuselage (with its huge rear-door cutout) the final arrangement was as depicted.

An unconventional feature was the use of blowing over the slotted flaps and drooped ailerons. The flaps were fed from the main powerplants, and relevant data include: take-off, flaps 20°, engines 15,250 r.p.m., bleed 3 per cent (6.5lb/sec) at 200lb/sq in in at 670°K, giving 2,670ft/sec (M1.6) at the slot, and resulting in a loss of some 500 s.h.p. per engine; landing, flaps 60°, engines 13,500 r.p.m., bleed 8 per cent (17lb/sec) at 173lb/sq in at 628°K, giving 2,470ft/sec (M1.5) at the slot, for a loss of 1,130 s.h.p. per engine. The ailerons were to be blown from auxiliary power units (Turboméca Tramontanes were suggested) located one in each undercarriage fairing and also used for engine starting; total aileron flow was to be 11lb/sec, slot conditions being 45lb/sq in, 400°K and 1,580ft/sec (M1.2). Approach speed at maximum landing weight was calculated to be only 95kt.

1960 *Passenger transport* Taking the bull by the horns, Cranfield have decided this year to scheme an M2 airliner for transatlantic operation. Owing to the magnitude of the project many aerodynamic and structural investigations are taking place preparatory to beginning the actual design in October.

It has been found that the optimum shape is a slender (Gothic or ogee) delta with an integrated body, the pressurized area comprising a pair of intersecting tubes side-by-side, with a pierced diaphragm joining the points of intersection. Pressurized to 11lb/sq in this complete "double-bubble on its side" would be accommodated between upper and lower continuous wing surfaces forming a secondary pressure-tight volume which could hold about 6lb/sq in in the event of failure of the primary cabin. Airlines might dislike a gangway in each "tube"; but one would imagine such an interior would be popular with passengers, except for the fact that there is nowhere to put a window. Eight turbojets are postulated: studies have shown that only half the fuel is used in true cruising flight drifting from 58,000 to 65,000ft, and that structure weight is more important than L/D in range calculations. Considerable conical camber makes the spanwise lift distribution less rectangular (to reduce bending moment), and should make drag due to lift a minimum in the cruise.

In the Department of Aerodynamics a 1/48th-scale model is being tunnel-tested for low-speed longitudinal and lateral stability, while analogue computers are investigating pressure plots, performance and stability. One student is evaluating a computer programme for analysis of the structure by displacement methods. Preliminary calculations indicate that the principal stressing cases are the landing (15 times the normal flight bending moment) and dynamic-braking. Stiffness requirements seem severe, and aeroelastic investigations of static stability and elevator effectiveness are in hand.

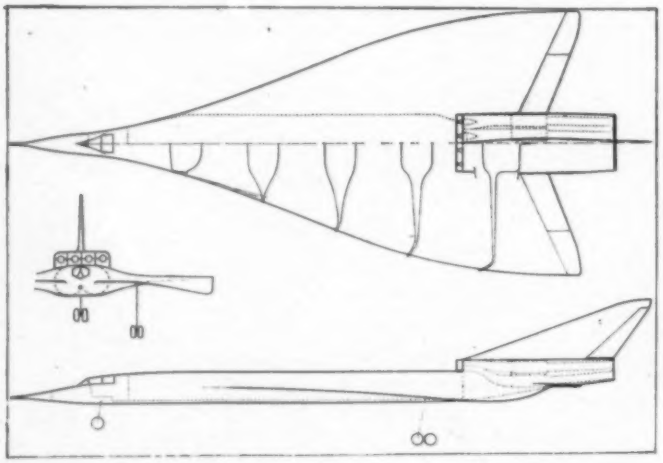


1959 F.59 general-purpose freighter. Four Rolls-Royce Tyne 11. Span, 148ft 4in; length, 137ft 6in; track and wheelbase (to bogie centres), 20ft 6in and 47ft; hold dimensions (exclusive of nose door), length, 99ft 10in back to rear 7ft-high bulkhead; width, 14ft; height, 11ft; gross weight, 200,000lb; payload, 77,000lb for 800 n.m. (still-air) or 22,400lb for 4,600 n.m.; cruise at 14,100 r.p.m. (max cont), at 190,000lb, 374 m.p.h. at 15,000ft

Studies in Design . . .

1957 *Big jet transport* Forming an interesting comparison with the VC10, this project was intended to carry 200 passengers on a non-stop daily return service across the Atlantic. Following the practice long established at Cranfield, the powerplants were hung on the rear fuselage. Unlike the VC10 the four engines were mounted in superimposed pairs, and to reduce cabin noise the intakes were kept well aft. It was found that the optimum aircraft had a double-bubble configuration, with the wing mounted immediately beneath the upper deck to give adequate ground clearance for the large flaps. Big bogies were placed near the centreline, and outriggers retracted into pods ahead of the leading edge. Under the main floor were large pressurized compartments for freight and systems. It would have been a simple matter to evolve a military version with a rear ramp for vehicles and heavy dropping.

1958 *Tactical strike* A particularly novel—indeed daring—design, this aeroplane was intended to accomplish a variety of missions at M1.5 right down to sea level. To this extent it represents a more radical approach than the NA.39 formula and can be regarded as a rather smaller precursor of the TSR.2. The problems posed by such a requirement are exceptional. Not the least is that in any ordinary aeroplane the crew would have a fatigue life measured in seconds (the RAF would probably say that such an environment would shake their eyeballs out!).



1960 supersonic long-range airliner. Eight turbojets, each of 22,500lb thrust. Length, probably approximately 200ft; gross weight, approximately 310,000lb; designed to carry 120 passengers on a non-stop transatlantic stage, accelerating to supersonic speed at 36,000ft, climbing to 58,000ft and then gradually to 65,000ft, decelerating at 36,000ft and making a 200 n.m. diversion from 5,000ft to 20,000ft and stand-off at 5,000ft to make 15 per cent contingency fuel; cruising speed, about 1,270kt (M2.2)

The cockpit of the Super Aero used for charter flying by Maitland Air Charter and entered by "Flight" in the Business and Touring Aircraft Competition (see page 9). This aircraft was fitted, to comply with public transport requirements, with Sperry and Kelvin Hughes flight instruments, duplicated alternators, Marconi AD.722 miniaturized ADF (the pilot is tuning it in this picture) and two Standard Telephones STR.9Z 44-channel VHF radios. The work was done by Air Couriers Ltd

FLIGHT SYSTEM SURVEY

Caribbean Communications

WITH a call made from Barbados to Trinidad, the "world's most advanced inter-island and aeronautical telecommunications system" was officially inaugurated last month. The £500,000 multi-channel VHF scheme was engineered with International Aeradio Ltd by Pye Telecommunications Ltd and Ericsson Telephones Ltd to provide automatic telephone and teleprinter services for the Caribbean islands and can provide immediate contact between any airport, airline office and aircraft.

Twelve simultaneous voice channels and between 12 and 18 teleprinter channels are provided over the main route between Trinidad, Grenada, St Vincent, St Lucia, Dominica, Antigua and St Kitts. An All-American Cable & Radio Co link connects to St Croix, Puerto Rico and North America and there are several spur circuits.

The initial survey was made four years ago by IAL and roads, power supplies and hurricane-proof buildings have since then been set up. All radio units are duplicated and provided with automatic changeover with remote indication of this at a control centre at Trinidad. Automatic dialling is possible to any part of the network and all telegraph messages are automatically routed and selected.

Eurocontrol Progress

IT has now been decided that a convention on international European control of high-level air traffic shall be prepared by the end of the year and that two new agencies shall be formed. The first is to be called Eurocontrol, the name already used during the discussions which have taken place over past months. It will be "an international public service, financially autonomous, responsible for air traffic control in the upper airspace." The other is to be the Permanent Commission for the Safety of Air Navigation, a corporate body responsible for the general supervision of the Eurocontrol agency.

CSF Television Band Compressor

THE French Compagnie de Télégraphie sans Fil has announced the development of a television band compressor system by which the television picture derived from a radar presentation by means of the TI 440 transformer may be transmitted over normal 10kc/s telephone lines.

When the required rate of information is not high, the new adapter reduces the rate of scan so that the bandwidth may be compressed. At the receiving station, a picture transformer-expander restores the video signals to the original standard and the picture may be presented on a slow-scan or normal television receiver. CSF envisage applications beyond the ATC field.

FAA To Study Work Load

VOLUNTEERS among the 17,000 FAA controllers manning traffic control centres and airfield towers are to participate in an extensive survey of "environmental stress factors relating to controllers' working conditions." The object is to obtain clear-cut medical data on which to base a new assessment of shift lengths and rotations and retiring-age factors for traffic controllers.

A carefully planned series of projects will provide information on mental resilience and physical stamina, long-term psychological and physiological effects and the effective physiological limits of men working in this field. The side-effects on mental acuity of certain commonly used drugs such as aspirin, the effects of diet, stress and fatigue on energy output and the incidence of stress-related diseases among controllers compared with that in other people will all be studied. A 2lb telemetry radio carried on the body will be one of the tools used.

The whole programme will be run by the FAA's Bureaus of Aviation Medicine and Air Traffic Management and Office of Personnel and Training.

Ceramic Gas-bearing Gyro

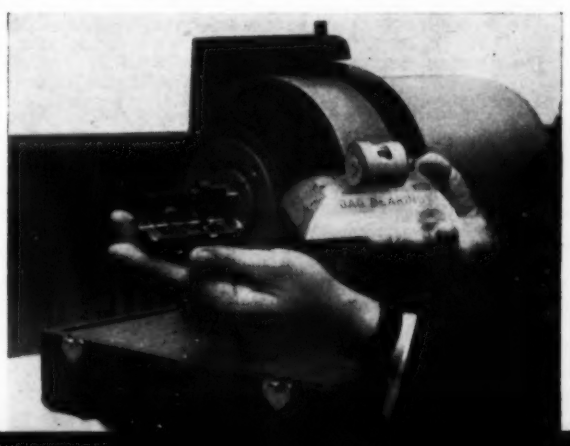
CONSIDERABLE increases in inertial gyro accuracy are apparently offered by a new method of construction developed by Minneapolis Honeywell Aeronautical Division. The process employs a rotor made of ceramic material running on gas bearings, the complete unit being mounted in the conventional floated gimbal. Prototypes of the new Honeywell gyro have now completed considerable running and pre-production versions should be available towards the end of this year. Production versions are to follow.

The new integrating gyro measures 2.8in in diameter by 2.75in long and weighs 0.68lb. The rotor spins at 12,000 r.p.m. and has an angular momentum of 120,000 gramme cm²/sec. The gas bearing between rotor and stator actually has a clearance of only 0.000025in, normally a press fit, and both the surface finish and hardness of the material must be specially prepared. Initial wear during starting when the gas has not yet begun to flow must also be avoided. Honeywell cast and fire the ceramic material to a hardness almost equivalent to that of diamond and have achieved high dimensional stability over a considerable temperature range.

Ceramics are also used in thin strips to insulate the layers of the stator field windings and as a coating for the wire itself. The complete stator unit is fired to form virtually a potted unit. The main castings are ground and polished during and after the firing process. When spinning, the complete gyro can withstand a 30g shock without "bottoming." Minneapolis Honeywell claim that they have measured drift rates a factor of ten better than those of earlier gyros and that bearing vibration has been reduced by an even greater margin. The life of the unit in a missile which is repeatedly test-run is also improved.

The Lear Miniature Yaw Damper

A RECENT note on this page referred to the marketing by Lear Inc of a miniaturized single-axis damping system for high-speed aircraft. It is now learned that the correct figure for the contract placed by Fiat, for fitting in the G.91, is $600,000.



The new Minneapolis Honeywell integrating gyro with ceramic rotor displayed next to the floated gimbal containing the ceramic parts

U-2 Echoes and US Budgets

BY DON ADAMS

THE recent downing of an American U-2—either by Soviet action or, as is more widely supposed in the US, by an untimely mechanical failure—has stimulated anew the "battle of the budget." The President's balanced budget concept had been subjected to criticism when it first appeared some time ago; and Premier Kruschev's verbal counterblasts have caused opposition to a balanced budget to be voiced in many quarters. Senator Henry Jackson, for a long time critical of the Administration, has called for an immediate rise in defence appropriations of between 2,000 and 3,000 million dollars.

Heeding this and other demands, many newspapers have opened campaigns for greater defence preparedness. Even the carefully conservative *New York Times* in a May 30 (American Memorial Day) editorial suggested that "a re-examination of the defence budget in light of recent events seems clearly to be in order." Any re-analysis which may take place will probably consider the following relevant points.

The U-2s So much has already been written about these unusual aeroplanes that one need only preface the succeeding paragraphs with the observation that the U-2 is evidently able to maintain level flight at altitudes well above that achievable by any other contemporary aircraft. Just how high the U-2 really can fly is the subject of much public speculation. US radio reports have quoted a Lockheed spokesman as having privately advised that the operational altitude is close to 100,000ft.

According to some reports, U-2s have made no fewer than 150 sorties into Russian territory. Allegedly, they have photographed every square inch of land behind the Iron Curtain in the past four years. Several reasons are cited for the flights. The first was to obtain up-to-date information on Russian aircraft and troop movements, and to discover hidden military installations such as aerodromes and ICBM launch pads. Another purpose was to assess Russian anti-aircraft defences. Of particular interest were radar sites and fighter interception practices. These "justifications" were widely known, but a further type of mission which may have escaped general notice is that of ordinary geodetic map making. In America one can easily purchase directly from the Government the most accurate of maps of the Continental US. However, with the Soviet fetish regarding secrecy, there is little available data concerning the Russian land masses. The only accurate information available to the West had been derived from aerial reconnaissance photographs taken by German aircraft during the last war. But what the Germans didn't photograph was most of Russia beyond Moscow, and these vast areas have remained a mystery to the West. The question was not so much as to whether a certain air base existed, but as to *exactly* where it was located. According to some reports many industrial complexes and airfields could not be pinpointed closer than several miles. Certainly a better knowledge of target location was required if ICBMs were to be at all effective in any future conflict.

The May 1 Flight It appears likely that "the" U-2 flight was made for the purpose of getting a photograph of the Russians' big booster on the launch pad. Everyone had been aware that the Soviets had planned a spectacular space shot to coincide with the Summit meeting. Subsequent to the meeting, of course, Russia did make such a firing (*Flight*, May 20). The Soviet rocket must hence have been on the pad on May 1 and the CIA must have viewed this as a good opportunity to catch a further glimpse of the vehicle. Paradoxically, therefore, the pre-summit flight was possibly occasioned by Russian propaganda efforts. And it is interesting to speculate that if the Soviet Union hadn't planned to impress the world with their "summit shot" the U-2 incident might not have occurred.

Effects of the Reconnaissance Data The Administration's past policies of holding down defence spending well below the level advocated by some can now be viewed in the light of the U-2 incident. In *Flight* for March 13, 1959, it was noted that the US had programmed large-scale production of the B-52 in the early nineteen-fifties because, among other reasons, the Russians had given substantial outward indications that they would build a huge bomber fleet. They didn't; but, because of inadequate intelligence, America engaged in a "numbers race" in heavy bomber aircraft. The Russians have continually alleged that the B-52s (maintained, as many of them are, on an air alert status) are a threat to peace; but it is well to remember that the B-52 fleet was constructed to meet a threat of unknown proportions.

Interest in the numbers game has now shifted to ICBMs. And there are many in America who would match *projected* Russian missile numbers with equal numbers of US missiles. Strangely (or perhaps not so strangely, in the light of the U-2 affair) the Administration has strongly resisted the pleas to follow past practices and engage in a race. Apparently the U-2 flights had given rise to serious doubt about projected Russian ICBM inventories.

Hence the U-2 flights may have actually served to *hold down* defence spending. The anomaly here is that the Russians have urged this very point in their disarmament talks. When intelligence data was lacking the US responded by countering perhaps the worst of suspected Soviet threats. But through the reconnaissance flights America saw fit to hold down defence spending. The policy of "Open Skies," as advocated some years ago by President Eisenhower, may therefore have already been proven to be a most effective step towards real reductions in arms.

Increasing the Budget Why, then, should America now increase her defence budget? If US aircraft have roamed Russian skies for years it is likely that existing American ICBM production is attuned to what they may *know* to be Soviet strength. Some of the reasoning behind the demands for extra spending is difficult to comprehend.

A particular case has been made out for renewing emphasis on the B-70 programme. General Thomas D. White, Air Force Chief of Staff, testified recently before Congress: "I think recent events prove the ease of penetration." This is unequivocally true [Are we sure?—Ed.], but there never had been any question about the B-70's ability to penetrate the most modern of defences. The main justification for that machine had been that only manned aircraft were able to strike Russian targets, the locations of which were imprecisely known some years ago. But since the U-2s had provided much-needed target location data the need for the B-70 was reduced. ICBMs could now be relied upon to level military targets at a far lower cost than could B-70s.

Nevertheless, the prevailing mood in America seems to favour an increase in defence preparedness. Perhaps a 10 per cent increase will be forthcoming. The B-70 will likely be favoured by some additional funds and ICBM production may be raised. Speeding up the Minuteman programme might be a logical step. Additional Polaris submarines may be bought, and the nuclear-powered aircraft is now being funded.

The U-2 and History No amount of words can justify the incredibly ridiculous manner in which the U-2 story was first revealed to the world. Handling of the affair was regrettably bungled.

But future generations may look upon this odd aircraft with a fresh perspective. Here was a vehicle—device, a method—which gave a nation the knowledge it needed to assure itself that it would not suffer the disastrous consequences of a surprise nuclear-age attack. And despite what the rest of the world believed the US—although she, too, would have liked to believe otherwise—felt that a threat to peace did exist. Without a guarantee against being attacked, which was the case before the U-2s, armament appeared to be the only recourse. The Soviet Union necessarily armed itself to counter real American strength. Misinformation breeds distrust, which in turn caters for an arms race with its ever-increasing frictions.

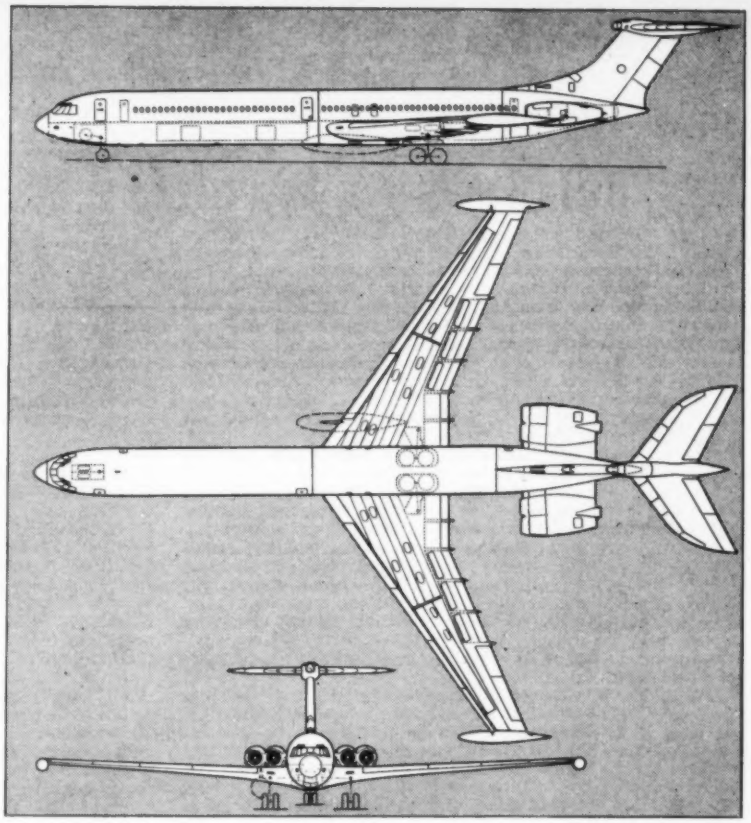
The U-2 flights are probably ended. Some reports have mentioned that a successor to the type was being built at the time of the Summit but had since been cancelled. If any new aircraft were being built it would appear logical to cancel them. Current events preclude their use.

Satellite Reconnaissance Whereas aircraft flights over another country are accepted to be a breach of sovereignty, satellites of both great Powers have been orbiting over one another's lands for some years. The American Tiros vehicle mounts a camera system for weather observations, though the optical resolution possible with the system seems far too poor to be of any military significance. But a precedent has been established. It will be interesting to see what attitude the UN adopts with regard to national boundaries in outer space. Will they condemn the usage of reconnaissance satellites such as America's Samos/Midas vehicles? It is hard to understand that they would. If by deriving intelligence data which will allow a reduction in armaments these vehicles can bring us an inch closer to peace, then their use should be condoned. A point here might be that cries will be raised to outlaw such satellites on the premise that they could contain nuclear weapons. Surely this objection could be eliminated by the simple expedient of placing neutral observers at all launching sites (just as the Russians could have ascertained that the U-2s did not carry weapons by the simple means of having observers at U-2 airfields; this point, of course, was part of the original open skies plan).

How much better it would be to look up and see a foreign satellite—with or without cameras—rather than a hostile bomber or ICBM.

AIR COMMERCE

Super VC10



ON Thursday of last week, June 23, the chairman of BOAC signed a contract with the British Aircraft Corporation for the purchase of ten Vickers Super VC10s for delivery beginning "early in 1965." Value of the contract is stated to be "some £25 million without spares." After signing the contract Sir Gerard d'Erlanger said: "The Super VC10 is intended for BOAC's North Atlantic routes on which the constantly mounting tourist traffic offers immense dollar earning opportunities . . ." Sir Gerard added that the order "completes BOAC's current aircraft fleet requirements."

Sir Gerard d'Erlanger signed the contract for 35 standard VC10s on January 14, 1958. Contractual commitment in respect of this order was given in BOAC's last annual report as £89.3 million, a sum which includes spares. Without spares, according to Vickers, 35 standard VC10s cost £60 million—indicating, incidentally, that BOAC are having almost 50 per cent spares. Price of a standard VC10 (35 at £60 million) is therefore about £1,715,000. The Super VC10 is evidently 45 per cent more expensive, unit cost (10 at £25 million) being £2.5 million. But in terms of productivity, a measure of value for money, BOAC are buying an aircraft with a 52½ per cent greater ton-mile per hour capability.

The Super VC10 is intended for special high density routes such as the North Atlantic. On these routes the Super VC10 is capable, in one configuration, of carrying 212 economy passengers, 62 more than in the standard aircraft. This extra payload capacity has been obtained by extending the VC10 fuselage by 29ft—20ft of this extension being in front of the wing. The basic design remains as for the VC10, the necessary stiffening being built in without alteration to the aerodynamic shape.

The engines are Rolls-Royce Conway RCo.42/2, Stage 2 version of the engine intended for the standard VC10 (and for the 707-520 and a DC-8 development). The Stage 1 Conway 42 has a guaranteed minimum thrust of 20,250lb, a cold-hot by-pass ratio of 0.6, a cruise specific fuel consumption of 0.785, and production deliveries are due early in 1962. This is the first announcement of the Stage 2 Conway 42.

The standard VC10 was designed to carry maximum payload out of airfields with only medium length runways. The rear-engined layout, conferring full span slats and flaps, allows the VC10 to overcome the weight and payload restrictions experienced by the DC-8 and 707 as a result of runway limitations. For example, even on a fairly long (9,570ft) runway at ISA+10°C (77°F) a standard VC10 can lift 4,000lb more payload (using 8,870ft) than a comparable DC-8 or 707. This is for a 3,950 st. mile stage against a 66kt headwind.

Some major airports, e.g., London, are proposing to extend their runways; runway number 5, 10R/28L, at London Airport, for example, is to be extended to 11,000ft and eventually to 12,000ft. New York's jet runways are already 11,250ft and 11,800ft. A manufacturer will obviously take full advantage of such runway lengths, and maximum permissible take-off weight of the standard VC10 has been increased from 299,000lb to 347,000lb in the Super VC10. Maximum payload goes up from 38,000lb to 58,000lb—an increase of more than 50 per cent.

The fuel capacity of the Super VC10 has been increased over the standard aircraft by 12,000lb (from 17,250 to 18,750 Imp gal) by the addition of two 750 Imp gal tip tanks. The extra fuselage length has increased the size of the underfloor freight holds from 1,350 cu ft to 2,000 cu ft of useable volume; a second freight loading door has been added. The Super VC10 is capable of accommodating up to 20,000lb of baggage and cargo at normal freight densities.

The layouts possible in the Super VC10 include 161 seats mixed class (50 first, 111 economy), and also a 187-seat configuration. This will be adopted by BOAC; seats are in threes, there are two galleys, and seven passenger- and one crew-toilet. By reducing the number of toilets by one, and using an accessible downstairs compartment for wardrobe and food storage, etc, the number of economy-class seats can be increased to 212.

With maximum 58,000lb payload and reserves for 1hr hold-off and a 230-mile diversion, the Super VC10 can fly a stage of just over 4,000 st. miles in zero wind, ISA temperature. On London - New York (a stage length of 3,950 st. miles, with strong headwinds usually encountered) the Super VC10 can carry its fullest possible complement of passengers and baggage plus 8,000lb freight.

Sir George Edwards, managing director of the British Aircraft Corporation, said last week:—

"In our view—and this view is shared by BOAC—there will be a continuing world need for a large and economical subsonic jet for many years to come. This applies not only to high-traffic

(*Continued on page 27*)

A modelmaker's impression of the Super VC10. Most of the 29ft stretch is forward of the wing, which is the same span and area as that of the standard aircraft except for the addition of two 750 Imp gal tip tanks. Facts and figures comparing the Super VC10 and the standard VC10 appear in a table on page 27. Powerplant: Stage 2 R-R Conway 42s

AIR COMMERCE . . .

BRITAIN'S NEW AIRLINE

Pale blue cheat-line and red fin motif has been chosen as British United's colour scheme, soon to be seen on all the new company's aircraft. Styling is depicted in this Britannia model

FINAL agreement has now been reached on the details of the merger between Airwork and Hunting-Clan and the reorganization of the new joint company, British United Airways, is virtually complete. It will include, as well as these two companies, several of the former Airwork subsidiaries whose old individual names will now cease to exist. Chief among them are Air Charter, Morton Air Services, Olley Air Service, Transair, Airwork Helicopters (previously Fison-Airwork) and Bristow Helicopters. These two helicopter companies will be combined to form the Helicopter Division of British United Airways.

Three companies will retain their present names and individuality although they are wholly owned subsidiaries of British United. They are Airwork Services, the specialist organization at Hurn concerned with engineering, design and development, training and aircraft sales; Aviation Traders (Engineering), the Southend-based engineering and maintenance organization; and the Channel Air Bridge, which operates the passenger and vehicle-ferry services from Southend to the Continent. Of the airlines merged into British United, therefore, this is the only one to retain its identity. The red-and-white livery will be retained for the time being; fins already bear the legend "A British United Airways Company." The manager, Douglas Whybrow, has been appointed to the board of Channel Air Bridge Ltd.

British United Airways is backed by the Blue Star Line, the British & Commonwealth Shipping Group, Furness, Withy & Co, by T. L. E. B. Guinness, the Hunting Group of Companies and Whitehall Securities. Its board will consist of M. D. N. Wyatt, chairman; Sir Nicholas Cayzer, deputy chairman; R. C. Benbow, A. E. Bristow, Anthony Cayzer, R. L. Cumming, P. B. Guinness, L. C. Hunting, F. A. Laker, T. W. ("Sammy") Morton, G. N. A. Murrant, Lord Poole, B. R. Seton-Winton, J. A. Thompson and G. H. Trott. T. L. E. B. Guinness, who has been connected with Airwork from its earliest days, is president of the new company.

Several members of the board will assist the chairman as executive directors: Mr Cumming, secretary of the company and in charge of its finances; Mr Laker in charge of the Air Transport Division (fixed-wing); Mr Morton in charge of overseas contracts; Mr Bristow in charge of the Helicopter Division. Peter Lewindon has been appointed general manager of the Air Transport Division under Mr Laker.

British United's fixed-wing fleet totals 52 aircraft, including four Britannias, two DC-6As, eleven Viscounts, four DC-4s, thirteen Bristol 170s, and various other aircraft (see *Flight*, March 11, 1960, "The Big Independent Merger"). The main operations base will be Gatwick, where a four-acre extension to the existing Transair base is being negotiated with BEA, who own the land concerned. Aircraft will also fly from Southend (the Channel Air Bridge base) and Stansted.

The Helicopter Division is currently working on oil exploration and agricultural jobs in the UK, the Caribbean, Central and South America, the Middle East and Persian Gulf areas, and West Africa. Its main base in the UK is at Redhill, and it also operates from the London Heliport. Its fleet of 54 helicopters—which British United believe to be the largest in the world—consists of fifteen Whirlwinds, six Widgeons and thirty-three smaller helicopters.

Subsidiary and associated companies overseas are Straits Air Freight Express in New Zealand; Air Carriers in the Federation of Rhodesia and Nyasaland; Commercial Air Services (Pty) in the Union of South Africa, and Airspray (EA) in East Africa.

ANOTHER ACCIDENT AT RIO

THE fifth aircraft accident at Rio de Janeiro within 18 months occurred to a REAL Convair on June 25. All 53 occupants—48 passengers and five crew—are believed to have lost their lives. Wreckage was discovered in Guanabara Bay, the scene of a collision on February 25 between a US Navy R6D and a REAL DC-3. A previous accident occurred on December 22, 1959, when a VASP Viscount was in collision with a Brazilian Air Force T.6. A Super Constellation of Lufthansa crashed while approaching Rio on January 11, 1959; and a VASP Scandia crashed into Guanabara Bay on December 30, 1958.

The REAL Convair—it may have been a 340 or a 440, both of which are operated by REAL SA Transportes Aereos—was on a flight to Rio from Brasilia via Belo Horizonte. As it approached Rio it ran into heavy fog and rain and was unable to land at Santos Dumont Airport. It is reported to have circled for some time before it "disappeared," and the heavy fog hampered search operations. After wreckage was reported as having been sighted, a helicopter was used to confirm that it was that of the Convair.

Whilst it would be improper to prejudge this accident, it is proper to recall the warning, at IFALPA's annual meeting last March, of "serious deficiencies" in Brazilian ATC. IFALPA urged the adoption of the ICAO regional plan long-shelved by the Brazilian Air Ministry.

NEW PERSIAN MAGIC CARPET

THE freight carrier Persian Air Services blossomed as a passenger carrier on June 20 when it inaugurated its first DC-7C service between London and Teheran. Six years old, the company has previously operated freight services from Teheran to Beirut, Athens, Basle and Brussels using DC-4s, and for some while a chartered DC-6A. Recently they have acquired two DC-7Cs from Sabena, with whom they are associated and who are supplying crews for the DC-7C operation. PAS are now operating thrice-weekly evening-departure passenger services between the two capitals. Accommodation is 35 tourist-class and 12 de luxe seats, but the airline emphasize that the 7C in this form has considerable residual space for freight. The forward part of the fuselage is blocked off for freight carriage, total capacity for which—including under-floor holds—is 5,000kg. Two services a week operate out of London; one via Brussels and Geneva and another via Paris. A third service starts at Brussels and operates to Teheran via Geneva. This connects at Brussels with a Sabena service from London.

The newcomers are in competition with seven established carriers on this route, namely Air France (in association with TAI), Alitalia, BOAC, Qantas, Pakistan International and PanAm.

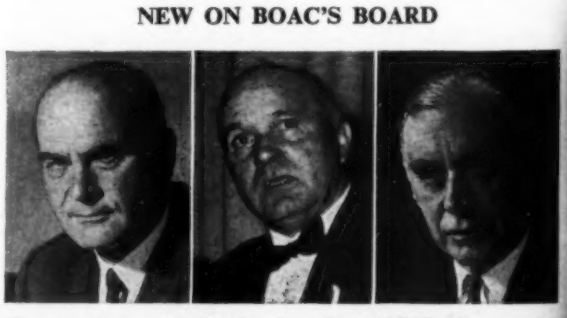
PAS have offices in Brussels where the director of operations for Europe is Mr Goossens. The United Kingdom commercial manager is Mr K. F. Lyons, and a PAS office is shortly to be opened at 1 Grafton Street, London W1.

MORE HOURS FOR THE PROTEUS

RECENTLY authorized by the ARB is an extension of the overhaul life of the Proteus 705 from 2,000 hours to 2,400 hours. Proteus overhaul period has been extended to 1,300, 1,600, 2,000 and to 2,400 hours more quickly, it is claimed, than that of any aero-engine; certainly few engines have previously achieved an overhaul life of 2,400 hours.

Overhaul costs of these engines, say Bristol-Siddeley, have been reduced by more than 75 per cent since entering service.

NEW ON BOAC'S BOARD



These are the new part-time board members of BOAC, whose appointments—together with those of the chairman and the deputy chairman—are recorded on page 26. From left to right, Mr J. A. Connel, Mr Lionel Poole, Sir Walter Worboys

ROYAL COMET 4 ENDURANCE

WHAT appears to have been a jet airliner endurance record was set up during the Duke of Edinburgh's recent journey to Ottawa on a special BOAC Comet 4 flight. (From Ottawa, it will be recalled, Prince Philip flew on to New York to open the British Exhibition.) The Comet was in the air for 8hr 45min on its flight from London (commander: Capt Kelly, deputy Comet flight manager), arriving overhead Ottawa with 5,000kg of fuel in the tanks, and 3,700kg unused when the engines were stopped.

Total distance covered was 3,150 n.m., a distance substantially more than great-circle due to the fact that the aircraft departed from such a track in order to take advantage of a tailwind component (8kt average) over Greenland. Height during the last hour of this pressure-pattern-flying operation was 43,000ft, in an outside air temperature of between −45°C to −49°C. Mach number was reduced from 0.73 at the start of the cruise to 0.66.

DART HERALDS FOR VASP?

TO supplement the brevity on page 27, Handley Page have given *Flight* more background to the recent encouraging reports of possible Dart Herald sales in South America.

Airlines in Brazil and Argentina have, say H.P., written to the firm "declaring an intention to buy a minimum of 16 Heralds." This follows the recent see-it-in-action Herald sales demonstration tours in South America. VASP (Viacao Aerea Sao Paulo SA), for example, is expected to sign a final contract shortly for the initial supply of seven Heralds. They are needed to replace its 15 Scandias and 13 DC-3s and will complement its four Viscounts. This order for Heralds will be VASP's first step towards its ultimate goal of operating an all-turboprop fleet of Viscounts and Heralds, all powered by Rolls-Royce Dart RDa.7 series engines overhauled by Rolls-Royce in Sao Paulo.

Other major Brazilian airlines which have evaluated the Herald, together with the Brazilian Air Force, are interested in both the standard version and also a development with a longer fuselage and an increased all-up weight of 41,000lb giving a 2,000lb bonus in fuel or payload.

Negotiations are proceeding with several of these Brazilian operators and H.P. has "expressed its willingness to undertake the assembly and eventual manufacture of the Herald and its developments in Brazil."

TO ASSIST MR SMALLPEICE

Alan Ponsford, BOAC's deputy chief press and information officer, has been appointed as an assistant by Mr Basil Smallpeice, the corporation's managing director. Mr Ponsford joined BOAC in April 1946. Acting as deputy to Mr F. C. Gillman will be Mr T. I. Pyle

THE ACCIDENT TO BRITANNIA G-AOVD

THE opinion of Mr P. G. Tweedie, Chief Inspector of Accidents, Ministry of Aviation, is that the crash of BOAC Britannia G-AOVD on December 24, 1958, resulted from failure of the captain and first officer to establish the altitude of the aircraft before and during the final descent. In his report* he places the responsibility for the accident upon the captain but gives as a contributory factor the height presentation afforded by the three-pointer altimeter fitted. This was "such that a higher degree of attention was required to interpret it accurately than is desirable in so vital an instrument." The aircraft, under the command of Capt J. E. Jackson, was making a test flight following a check 4.

After examining the qualifications of the crew—Capt Jackson was "a reliable, competent captain with exceptional ability," and the first officer and chief engineer officer had been assessed as having "above average ability"—the report quotes in detail the weather forecast for the area between 1000hr and 1200hr on the day of the flight. In the vicinity of Hurn Airport, there was complete coverage of fog and low stratus with tops at 1,500ft, and small amounts of alto cumulus at about 10,000ft to 12,000ft.

The Britannia left London Airport at 1010hr and took off into a cloudless sky. On board were the captain and first officer, an engineer officer in the jump seat and other engineer officers at the radio and navigation officer's positions. In the passenger compartment were seven BOAC personnel. An altimeter check was made at 3,000ft and again at 5,000ft. Afterwards the climb was continued to 18,000ft and altitude, speed and temperature were recorded every 30sec. No spoken cross-check of altimeters was carried out during the climb as "so many readings were being taken." Discrepancies of about 5kt were noticed in the readings of the captain's and navigator's airspeed indicators.

At the top of the climb the aircraft was put through a series of handling tests, including stalls and protracted rate-of-roll checks during a descent at 500ft/min. On completion of these checks Eng Offr Buckley noticed the 1st officer's altimeter reading what he believed to be 13,000ft and the captain asked the 1st officer to get clearance to descend to 3,000ft. The 1st officer called Hurn and asked the height of the top of the cloud base. No estimate could be given and a minute later the 1st officer replied, "We would like permission to descend to 3,000ft. We are VMC on top at 13,000ft just above a cloud layer." A course was steered towards Hurn for about 18min, when the 1st officer called overhead Hurn at 12,000 VMC on top and requested a descent clearance to 3,000ft. Asked whether the descent could be made VMC the 1st officer replied, "Negative. There is a cloud layer at about 10,000ft." However, states the report, it would seem that the only cloud layer which existed in the vicinity of Hurn was on or near the surface.

The aircraft was given clearance and descended into haze. First Officer K. Myers, on passing through it, expected to see a second layer below, but to his surprise (notes the report) the ground suddenly appeared. It was too late to prevent the Britannia striking it and the aircraft crashed. Nine of the occupants, including Capt Jackson and all the passengers, were killed.

The navigator's altimeter was damaged by impact but the captain's altimeter functioned within its specified accuracy. A check was made of the discrepancies in the airspeed indications recorded during the flight, but the report concludes that a pressure leak found on the 1st officer's instruments could have had only a small effect—in the order of 300ft too low at 20,000ft.

Using the 750ft/min rate of descent associated with the configuration of the aircraft when it crashed it was calculated that the aircraft was at 2,000ft and not at 12,000ft when it reported. Some 10,000ft was lost without either pilot appreciating it before the first call for descent clearance was made. The report concludes that the captain misread or failed to read the indicated altitude of the aircraft during the concluding stage of the flight and that the 1st officer misread his altimeter by approximately 10,000ft. The responsibility for the accident, concludes the report, rests with the captain, but as a result of representations made on behalf of Capt Jackson and by Mr Myers, the injured 1st officer, the comment in the first paragraph about interpretation of the three-pointer altimeter was added later.

Following publication of the report came a statement from the British Air Line Pilots Association recording that they were "profoundly disturbed . . . that the Inspector . . . should state that in his opinion the responsibility for this accident rests with the captain.

"If a three-pointer altimeter of the type in question *is* misread," the BALPA statement continues, "some proportion of the blame must attach to those responsible not only for fitting the instrument in the first place, but for continuing to fit it after its ambiguity was proved, and also to the regulatory authorities who approved the instrument as being fit for the purpose.

"In the opinion of the Association the accident to the Britannia at Hurn was largely design induced."

**Civil Aircraft Accident. Report on the accident to Britannia G-AOVD which occurred on December 24, 1958, at Sopley Park, Christchurch, Hants. Price 1s 6d, HMSO.*

The third double-flow jet airliner to fly, this Boeing 707-120B (P. & W. JT3D turbofan) for American Airlines flew at Renton on June 22. First such was the 707-420 (R-R Conways) in May 1959, followed by the Conway DC-8 series 40 in July 1959. Another double-flow jet airliner, Russia's Tu-124, is not yet reported to have flown

AIR COMMERCE . . .

BOAC's NEW TOP MEN

EACH of Britain's two airways corporations, the Air Corporations Act decrees, shall consist of a chairman, a deputy chairman, and "such number of other members as the Minister may from time to time determine." There is in fact provision for BOAC to have *two* deputy chairmen; and the Minister must not appoint more than eleven board members or less than five.

It is also plainly set out in the Act [Section 2(2)] that the Minister shall appoint the chairman and deputy chairman of each corporation "from among its members"—i.e., from among the members of the board, a point that seems to have been overlooked.

The Minister has not complied in the case of Sir Matthew Slattery who, as reported in last week's issue, becomes chairman in succession to Sir Gerard d'Erlanger on July 29, a few days after Sir Gerard's presentation of the 1959-60 report and accounts. The Minister has, however, complied with the Act in respect of Sir Wilfred Neden, who is promoted from the board (to which he was appointed in December 1958) to the position of part-time deputy chairman.

There are of course precedents for the appointment of the corporation's chairman and deputy chairman from outside rather than, as is decreed, from "among its members." Both Sir Gerard d'Erlanger and Sir George Cribbett, appointed respectively part-time chairman and full-time deputy chairman in May 1956, came from outside the corporation. When Parliament approved the Air Corporations Act in 1949 it obviously had in mind the desirability of promotion from the ranks; evidently this has not been found possible in the case of BOAC's chairmanship. How has the Minister complied with the requirement of the Act? A Ministry spokesman said last week that the Minister's letter to Sir Matthew appointed him a member *and* chairman of BOAC.

Rear Admiral Sir Matthew S. Slattery, KBE, CB, DSC, FRAeS, RN(Rtd), was born in 1902. He was educated at Stonyhurst and at the Royal Naval Colleges at Osborne and Dartmouth. He joined the Royal Navy in 1916 and qualified in 1924 as a pilot in the Fleet Air Arm, serving for a time in aircraft carriers. In 1938 he was promoted captain at the early age of 36. In the early war years, 1939-41, he was Director of Air Material at the Admiralty. He was then given command of HMS *Cleopatra*, a light cruiser, and was next appointed Director-General of Naval Aircraft Development and Production. In 1945 he was promoted to rear admiral and Chief Naval Representative with the Ministry of Supply. In 1948 he became Vice-Controller (Air) and Chief of Naval Equipment, Admiralty, and Chief Naval Representative, MoS.

Sir Matthew retired from the Royal Navy in 1948, in which year he joined Short Brothers & Harland Ltd as managing director, becoming chairman in 1952. In 1959 he was appointed a director of the Bristol Aeroplane Co and chairman of Bristol Aircraft, a position he held until the latter was merged with Vickers and English Electric as the British Aircraft Corporation. Sir Matthew's salary as full-time chairman will be £8,500 a year, with an expense allowance of £1,000.

Sir Wilfred Neden, CB, CBE, was born in 1893. He studied economics at London University and then joined the Army soon after the outbreak of World War 1, serving overseas with the Yeomanry and Royal Field Artillery. He was granted a regular commission in 1917, retiring in 1922 to join the Ministry of Labour. Following a spell in the Aliens Branch, he became responsible for recruitment under the Military Training and National Service Acts 1939-45; later he was appointed Under-Secretary of the Military Recruiting and Demobilization Department. In 1948 he became Director of Organization and Establishments, a position he held until 1954, when he was appointed Chief Industrial Commissioner. Sir Wilfred retired from the public service in 1958, joining the board of BOAC in December of the same year.

Sir Matthew Slattery

Sir Wilfred Neden

Three part-time members, all from diversified fields, are appointed. They are Sir Walter Worboys, Mr Lionel Poole and Mr J. A. Connel. Each will draw a salary of £1,000.

Sir Walter Worboys was born in Western Australia in 1900. He was educated at Scotch College, Western Australia, and Oxford University. He is chairman of British Tyre and Rubber Industries, and director of Westminster Bank and of British Portland Cement Manufacturers; he was formerly commercial director of ICI, and has held many important posts in the chemical industry.

Mr Lionel Poole was born in 1894. From 1919 to 1943 he was national organizer and full-time officer at his branch of the National Union of Boot and Shoe Operatives, and from 1943 to 1949 was assistant general secretary of the Union; he was general secretary from 1949 to 1959. During 1957-58 he was a member of the TUC General Council.

Mr J. A. Connel, born in 1903, was educated at Merchiston Castle School and Edinburgh University, where he obtained a degree in chemistry. He joined Lever Brothers in 1926. In 1933 he was assistant works manager of Joseph Watson & Son, and in 1937 held the post of assistant general works manager of Van den Berghs and Jurgens. In 1946 he joined Unilevers Group in South Africa as technical director, returning to London in 1950 to the Technical Division, Unilever House, where he became chairman in 1953. He was appointed a member of the Board of Unilever in 1954, and vice-chairman in February 1960. He has been a member of the board of BOAC's Associated Companies since 1957.

The new BOAC board is therefore as follows: Sir Matthew Slattery, chairman; Sir Wilfred Neden, deputy chairman; Basil Smallpeice, managing director; J. W. Booth; J. A. Connel; Keith Granville; L. Poole; Lord Rennell; F. Taylor; Lord Tweedsmuir; Sir Walter Worboys.

(*Leading article, page 1; other portraits, page 24*)

JAPAN'S NEW AIRLINER

PLANS for production of the YS-11, the twin-Dart feederliner designed by the Nippon Aircraft Manufacturing Co (NAMCO), are now finalized. Total production expenditure on four experimental YS-11s will be about £1,945,000. The six manufacturers concerned are participating as follows:—

Mitsubishi are making the fuselage and undertaking final assembly. Their contribution will be about £1.055 million, i.e., just over half.

Kawasaki are making the wing and engine nacelles. Their contribution is about £496,000, or about one quarter.

Fuji are making the tailplane, and contributing about £200,000, about one tenth of the total.

Shin Meiwa are responsible for the rear fuselage, and are contributing rather less than 5 per cent—about £103,000.

Nihon Hikoki are doing the ailerons and flaps, contributing £139,000.

Showa Hikoki are doing honeycomb structural components, and are contributing about £146,000.

NAMCO's capital is to be increased next October to a total of £1.22 million, of which £543,000 will be contributed by the companies, and the balance by the Japanese Government.

—AND ALL NIPPON GOES ALL-TURBINE

THE two ex-Capital Viscount 744s which were exchanged by the US airline in 1957 for two new 745s have been leased from Vickers by All Nippon Airways. The two aircraft, 52-seaters, are now in operation with the Japanese domestic airline.

Next year, in June and July, All Nippon are to take delivery of three Viscount 810 series; and according to a Japanese source the airline proposes eventually to purchase seven more V.810s. At the same time, notwithstanding progress with the indigenous rival product (see adjoining column), All Nippon are to take delivery of three Fokker Friendships in March and April 1961, and they are reportedly planning to purchase up to a total of 20 Friendships by 1963.

Footnote: The twelve D.H. Herons operated by Garuda Indonesian Airways since 1954 have been bought by the Japanese agents Itoh & Co for a unit price of about £4,500 each excluding spares. Average flight time of the Garuda Herons is said to be only 3,000hr. Three are to be sold to Japan Air Service, two more to Toa Airways, and five more are destined for export—three to Cambodia and two to Australia.

SUPER VC10 (continued from page 23)

routes, but to all trunk services. It is for that reason that we, with BOAC, have developed and are still developing the VC10 family of rear-engined transports. The great advantages of rear-mounted engines to both passenger and operator are no longer seriously disputed, and these considerable competitive advantages will accrue to BOAC in 1963 with the VC10, and in 1965 with the Super VC10 . . . Traffic on the North Atlantic is growing rapidly under the impetus of economy fares and special payment terms. The capacity of the Super VC10 is a recognition of this fact and we are very pleased to be able to offer such an aircraft, which we are convinced will be the right vehicle for its time."

THE TWO VC10s COMPARED

	Super VC10	VC10
Powerplant	4 R-R Conway RCo.42/2	4 R-R Conway RCo.42
Thrust	Not available	4 × 20,250lb*
Span	146ft	140ft
Length	186ft	158ft 10in
Height	39ft 6in	39ft 1¼in
Wing area (gross)	2,800 sq ft	2,800 sq ft
Max take-off weight	347,000lb	299,000lb
Max landing weight	241,000lb	197,500lb
Max zero fuel weight ...	219,000lb	176,500lb
Max design payload	58,000lb	38,000lb
Max no. of passengers ...	212	150
Max fuel	18,750 Imp gal	17,300 Imp gal
Cont. cruise speed	575 m.p.h.	552-587 m.p.h.†
Range	See text	*Flight*, 20.11.59, p. 621
Take-off	See text	*Flight*, 20 11.59, p. 621

*Guaranteed minimum. †30,000-40,000ft at 240,000lb.

ONCE AN HOUR TO PARIS

THERE is an old transport rule-of-thumb which states that ideal frequency of operation is reached when departures occur at intervals equivalent to the journey time. Although air transport frequencies only rarely reach this level outside the USA, they are doing so now on BEA's London - Paris service.

Delay in getting the Vanguard into service (BEA are still planning on the arbitrary date of October 1) has meant that from today, July 1, the number of flights planned to be operated with the Vanguard has had to be doubled; 30 Viscount flights daily are needed to carry the traffic and the average frequency of departure between 8 a.m. and 10 p.m. will be about one an hour.

The extra Viscount capacity needed for services on which Vanguards were scheduled has been obtained by acquiring additional aircraft. Two Viscounts have been chartered from Fred Olsen Flyselskap A/S for use on the London - Paris service and a further two transferred to this route from other operations. One 701, for example, will be replaced by a chartered Dan-Air Elizabethan which will operate Channel Islands services.

A result of the pressure on BEA's capacity is that no first-class accommodation is to be offered on the Paris service—it has been decided that it would be too difficult to convert all the Viscounts to a uniform first-class and tourist-class cabin layout. Nor will catering or bar services be available. A letter aimed at ameliorating the effect this may have on BEA's relations with its first-class passengers has been sent by Mr Anthony Milward, BEA's chief executive, to every prospective traveller.

BREVITIES

Butler Aviation of Chicago has purchased a Napier Eland Convair 540 for delivery in September. It will be converted for executive transport use. The aircraft concerned is N340EL, the original Napier conversion.

A central heliport is being built in Moscow from which services are to be operated to the three Moscow airports—Vnukovo, Bykovo and Sheremetievo. Sight-seeing facilities over Moscow may also be provided.

BEA placed a third repeat order for D.H. Comet 4Bs last week. One more was purchased, for delivery this year, to bring the BEA Comet 4B fleet up to 10. The original order, for six aircraft, was placed in September 1957.

BOAC are to open a sales office in Madrid on July 14 and in Lisbon on August 1. Both cities are served by Comet 4s flying between London and South America—to Recife, Sao Paulo, Montevideo, Buenos Aires and Santiago.

It is reported that the general manager of Turkish Air Lines, Ulvi Yenal, has been dismissed as a consequence of the military coup d'état. The Turkish Ministry of Transport is said to be investigating the purchases made by Ulvi Yenal's department during his term of office.

It is reported that VASP of Sao Paulo are likely to sign a contract for seven Dart Heralds. A Handley Page spokesman said last week that airlines in Argentina as well as Brazil had stated their intention to buy at least 16 Heralds. It is possible that the Herald may be manufactured in Brazil.

A DC-4 of Continental Air Transport is being overhauled by Hong Kong Engineering Co. A spokesman for the company says: "Airlines with flights to the Far East would find it well worthwhile to arrange for overhauls to be done in Hong Kong. Local labour costs make overhauls in Hong Kong a thoroughly economic proposition."

Slick Airways have now definitely ordered two Canadair CL-44s for delivery in September and October 1961. They have also placed an option on another four aircraft for delivery in 1962. The value of the order for the first two aircraft and spare parts is more than $9 million of which a payment of $900,000 has already been made. Of this $100,000 was paid over when the letter of intent was given to Canadair.

Issued last month by the SBAC is a pamphlet *Turbine Transport Order Book*. Corrected to June 2, it gives the number of Boeing 707s on order as 154, Boeing 720s 56, JT4-powered DC-8s 91, and Rolls-Royce Conway and JT3-powered DC-8s 56. The Society have also issued a list of the world's scheduled airline fleets for aircraft in service and on order. This is correct to May 24, 1960, and is arranged geographically.

Pan American has reduced its shareholding in Panair do Brasil from 48 per cent to 38 per cent. With US foreign aid funds, PanAm has bought a 49 per cent interest in Aryana, the Afghan airline. US sources say that of about £1.7 million US aid to Afghanistan, £1.1 million went into the airline. There is said to be a clause in the agreement whereby the US Government can buy the Pan American share at the original price.

Thai Airways are offering two DC-4s priced from $150,000 to $250,000.

The El Al order for two Boeing 707-420s (Rolls-Royce Conways) has now been confirmed. They are for delivery in May and June 1961, and an option has been taken on a third.

According to the chairman, Lord Douglas, BEA are expecting to make a profit in the current 1960-61 financial year, but it may not be as much as last year's estimated £2 million net.

The latest figures available up to April 30 show a total of 2,680,000 Viscount hours, and 1,715,809 landings. At that time 113 aircraft had each done more than 10,000hr, the highest being 14,236 logged by TAA's VH-TUE.

The result of the four-year-old General Passenger Fare Investigation conducted by the CAB into the fare structure of the US airlines is that the Board has agreed to allow fares to be increased from today, July 1, by an average of about 5 per cent. This is expected to give the airlines an extra $84 million revenue per year.

It is likely that Iberia's monopoly of Spanish domestic services will be broken by a bill now going through the Spanish parliament whereby Aviaco will be able to operate internal routes. Iberia are expected to concentrate on overseas routes, for which purposes DC-8s have been bought and de Havilland Comet 4Cs are reportedly being considered.

According to a US source the United Air Lines' agreement with Sud Aviation for the purchase of 20 Caravelles involves the transfer of eight United DC-6s and seven United DC-7s to a special company jointly owned by United and Sud. It is likely that Sferma, a Sud Aviation subsidiary, will convert some of these aircraft to all-cargo configuration in France. This arrangement is believed to be part of the Douglas-Sud Aviation technical agreement signed just before United purchased their 20 Caravelles last March.

This was the scene at Alitalia's base at Rome airport recently when Alitalia's first Caravelle was handed over by Sud-Aviation. She was baptized "Aldebaran" by Countess Caranbini. Alitalia are having four

A Westland Whirlwind of No 110 Sqn, on an improvised landing pad made from felled trees, during recent exercises with Australian troops in the Malayan jungle. The work of this RAF squadron, based at RAAF Butterworth, was referred to on this page on March 25

their role to the Royal Malayan Air Force. The Pioneers flew 16,100hr over the Malayan jungles, carrying 17,300 troops, 12,100 passengers and 3,449,000lb of freight and evacuating 500 casualties.

Hunters at Thornhill

A GOODWILL visit to Southern Rhodesia, reciprocating one made to Aden last November by No 1 Sqn of the Royal Rhodesian Air Force, is being undertaken this month by No 8 Sqn of the RAF. Based at Khormaksar and commanded by Sqn Ldr Rex Knight, this unit was re-equipped with Hawker Hunter FGA.9s last March: it has been Aden's resident ground-attack squadron for the past 32 years. No 8 is to do three week's flying training at RRAF Thornhill, from

SERVICE AVIATION

Air Force, Naval and Army Flying News

Victor in Rhodesia

RHODESIA is seeing a Handley Page Victor for the first time, during a week's visit by the AOC-in-C Bomber Command, Air Marshal Sir Kenneth Cross. The aircraft, in which he is flying as co-pilot, was due to leave RAF Gaydon on Wednesday and is returning there next Thursday. It is captained by Wg Cdr A. W. Ringer. Sir Kenneth's one-week visit to Rhodesia is being made at the invitation of AVM E. W. S. Jacklin, Chief of Staff of the RRAF.

Tribute to 209

HONOURED recently by being presented with a squadron standard (*Flight*, May 20), No 209 Sqn has now received a second honour—presentation by the Federation of Malaya of a kris (Malayan dagger) in recognition of the squadron's help during the Malayan emergency, which is to end on July 31. Dato' Abdul Razak, Malayan Defence Minister and Deputy Premier, presented the kris to the squadron's commanding officer, Sqn Ldr J. Cartwright.

No 209 (re-numbered from No 267 Sqn) flew over 4,000 jungle sorties in its Scottish Aviation Pioneers during the seven years up to last May, when they ceased to operate from Kuala Lumpur and handed over next Tuesday onwards. Ground crew are being flown there in Beverley and Valetta aircraft of No 84 Sqn.

Value of the ATC

SAYING he was "glad to see the end of pressed men," the Under-Secretary of State for Air (Mr W. J. Taylor) managed at Wolverhampton on June 21 to give the departing National Serviceman a pat on the back for what he had done and at the same time say the RAF was better without him. Speaking at Cosford, where nearly 2,000 boy entrants are being trained, Mr Taylor said it was important that the RAF should have "the right type of chap determined to make a success out of his life." It was doing very well for recruits, the most valuable single factor in recruitment being the Air Training Corps. At Cosford, about 35 per cent of the boys had been ATC cadets; in some spheres the proportion was as high as 50 or 60 per cent.

UAS Encampments

ALL the 17 University Air Squadrons are doing summer camp training at Service airfields: 16 of them at RAF stations and one, London UAS, at the Fleet Air Arm station RNAS Brawdy in Pembrokeshire. Some of the periods started last month and some continue until late September. The full list (giving only the concluding date, where a camp has already started) is as follows:—

Aberdeen: Waterbeach, to July 27; **Birmingham:** Martlesham Heath, August 3 to September 7; **Bristol:** Kinloss, to July 17; **Cambridge:** Martlesham Heath, to July 31; **Durham:** Gaydon, August 6 to September 3; **Edinburgh:** Hullavington, to July 17; **Glasgow:** Thorney Island, to July 19; **Hull:** Waterbeach, September 3 to October 1; **Leeds:** Valley, July 3 to 31; **Liverpool:** Thorney Island, August 28 to September 25; **London:** RNAS Brawdy, to July 30; **Manchester:** Cottesmore, August 19 to September 17; **Nottingham:** Tangmere, July 15 to August 13; **Oxford:** West Malling, to August 10; **Queen's:** Lyneham, to July 28; **St Andrews:** Tangmere, to July 9; **Southampton:** Valley, August 28 to September 24.

IN BRIEF

The Air Minister, Mr George Ward, flew a Handley Page Herald from Northolt to Radlett on June 17.

Four Lockheed C-130Bs are to go into service with the RCAF this autumn.

The annual reunion dinner of the CFS Association is being held at Little Rissington next Friday, July 8, at 7.30 for 8 p.m.

From today (July 1) the national headquarters of the RAFA is to be at 43 Grove Park Road, London W4 (tel CHIswick 8504).

The Under-Secretary of State for Air, Mr W. J. Taylor, visited RAF Binbrook last Friday to see men and women of the Royal Observer Corps in summer camp.

Flt Lt J. Vendrell, chief instructor at the Marine Craft Training School at RAF Mount Batten, has been awarded £25 for his invention of a marine craft simulator.

A Coastal Command unit badge was presented to No 1 Maritime Headquarters Unit, RAuxAF, on June 20 by the AOC-in-C, Air Marshal Sir Edward Chilton.

The RCAF "Golden Hawks" aerobatic team is again performing at Air Forces Days and major civil air displays in Canada this year. It recently made six appearances in the USA.

AVM P. G. Wykeham and senior staff officers of No 38 Group were taking part last Tuesday in a parachute descent from a Pioneer aircraft of No 230 Sqn into the sea off Lyme Regis, Dorset. The parachutists were being picked up by launches of No 1111 MCU.

Air Cdre W. S. Gardner, who from June 13 became Provost Marshal at Air Ministry, was a wartime bomber pilot who won the DFC in 1940 and a Bar to it in 1941. Until recently he was Head of the Plans, Training and Operations Division of the Central Treaty Military Planning Organization.

Sgt D. Nesbitt of RAF Wittering has been awarded £775 (£750 by the Air Council and £25 by the AOC-in-C Bomber Command) for inventing a portable bomb gear test box. Weighing only 70lb, it reduces the cost and simplifies the testing of bomb release systems in the V-bombers.

A new underground ROC group headquarters was opened at Maidstone last Saturday by Gen Sir Sydney Kirkman, Director-General of Civil Defence at the Home Office. Completely self-contained for operations in the event of nuclear war, it is the first of a number to be constructed on similar lines.

Since it was founded in 1919, the RAF Benevolent Fund has spent over £9m on the relief of distress, involving 431,230 awards. These figures are given in the Fund's report for 1959, the fortieth year of its existence. Last year the Fund expended £495,500 on total assistance of all kinds. It received £362,926 in subscriptions and donations.

C. E. Sargeant, editor of the *Joint Services Recognition Journal*, has been awarded £100 for his original contributions to the theory and practice of aircraft recognition training. Known as the Sargeant System of Visual Identification Training, this enables recognition to be largely self-taught. The award is the highest ever made under the Air Ministry staff suggestions scheme.

Avro Vulcan XH498 at RNZAF Ohakea before the successful test flight referred to on this page last week

Sport and Business

YORKSHIRE AEROPLANE CLUB held their annual At Home at the Leeds - Bradford Airport, Yeadon, in excellent weather on June 19. The main group of visiting pilots came from Newcastle Aero Club, who again won the Mailed Gauntlet trophy in the bombing competition. For the second year in succession members of the Yorkshire Club retained the Black-Mark trophy as a booby prize. Other prizes were presented by Arnold Wilson to M. J. Burn of Newcastle (sealed time of arrival) and R. H. Sherry, who had flown the greatest distance (from Stapleford Tawney) to attend. Among the visiting aircraft was the circus of Piper types from Vigors Aviation at Kidlington.

LONDON SCHOOL OF FLYING at Elstree are holding a rally on Sunday, July 10, to which all business, club and private pilots are invited. A prize will be awarded to the pilot landing nearest a sealed time between 1.30 and 2.15 p.m., and lunches will be available for visitors arriving before then if advance notification (telephone Elstree 2795) has been given. The aerodrome will be closed from 3 to 4.30 p.m., during which time a short flying display will take place. Visiting pilots are requested to check the signals area, as the circuit direction is left-handed in the morning and right-handed in the afternoon.

NOW AVAILABLE to private and business aircraft operators flying to the London area is the de Havilland Engine Company's aerodrome at Leavesden, near Watford. Located on the edge of the London control zone, the aerodrome is normally open from 7 a.m. to 4.30 p.m. on weekdays, but landings and take-offs during weekday evenings and at weekends may be made by prior arrangement with the Air Traffic Control Department. The aerodrome has a concrete runway of 1,020yd and two grass runways of 900 and 1,010yd. Refuelling facilities, parking space and hangarage are available, and maintenance snags can be dealt with by engineers from the company's service department. The telephone numbers of Air Traffic Control at Leavesden are Garston 4000, extension 199 and 200, and Garston 3674. The tower frequency is 122.5Mc/s (or, on request, 117.9) and homing facilities are provided on 122.3 or 123.3Mc/s.

ON-CALL CUSTOMS FACILITIES are now available at Cambridge Airport to private and club aircraft, provided 24 hours' notice is given. Arrangements for this service, which is being provided on a trial basis up to September 30, can be made through the Air Traffic Control Department at the airport (Cambridge 56293, extension 8). Normal hours are from 9 a.m. to 6 p.m. daily, although movements at other times can be arranged on request. Standard landing fees are charged, but no extra fee is involved in the attendance of the customs officers.

CHAIRMAN OF THE POPULAR FLYING ASSOCIATION for the last 18 months, Harold Best-Devereux has recently resigned from this post in order to devote more time to his private business. He has been succeeded by David Armstrong, a founder-member of the Association, with W. V. Fitzmaurice as vice-chairman. Following a recent PFA committee re-shuffle, Roy Mills is now handling group activities, John Blake Press and public relations, Ted Davis finance, A. A. P. Deverell construction and operation, and Eric King permits and inspections.

AT THE KRONFELD CLUB, London, on Wednesday next, July 6, Kenneth Owen of *Flight* will give a talk entitled *Introduction to Ballooning*. This will be based on his ascent in the Dutch balloon *Jules Verne* in the recent International Balloon Race at Rotterdam, described in our issue of May 13.

Latest version of the well-known Piper twin, the Apache G (two 160 h.p. Lycomings) incorporates a third window on each side aft, and is claimed to have lighter rudder loads than earlier models

A Safir, Jodel, Bonanza and Argus are in the foreground of this line-up picture taken at the Angers rally, reported on this page

THE FOURTEENTH INTERNATIONAL AIR RALLY of Wine, Flowers and Castles of Anjou, organized by the Aero Club de l'Ouest de la France in conjunction with the local vintners, was held on June 18-19 at Angers in the Loire Valley. Some 70 aircraft attended, most of which were French but including eight from the United Kingdom and a sprinkling of Dutch, Belgian, Luxembourg, Channel Islands and North African types. The oldest aircraft present was probably the Tiger Club's Hornet Moth flown over by J. M. E. Smith and John May. The weekend programme included a navigation competition, wine tasting contest, and inspection of a local wine-bottling plant. A photograph of the line-up of aircraft on arrival at Angers appears above.

RETROSPECT

From "Flight" of July 2, 1910

Labouchere Flies to a Café: While flying with Count Robillard on his Antionette monoplane at Chalons Camp the other day, Labouchere surprised his companion by suggesting that they should call at a café to get refreshment. Suiting the action to the word, he flew over to Mourmelon, and brought his machine to rest in a field outside a café. Having been served, the two aviators remounted their machine, and flew back to their headquarters at the Camp.

APPROXIMATELY TWENTY SAILPLANES from 16 member-clubs of the RAF Gliding and Soaring Association will take part in the 1960 RAF Inter-Command Gliding Championships at Odiham during July 16-22. This contest will be followed, from July 23 to 31, by the second annual Inter-Services Championships between the Royal Navy, Army and RAF. Task setting during the RAF meeting will be by Air Cdre G. J. C. Paul, founder of the RAFGSA, for many years its chairman, and now Secretary-General of the Air League. In charge of the overall programme will be Gp Capt R. R. Goodbody, the present chairman of the Association. Among competing pilots will be Gp Capt N. W. Kearon, deputy chairman of the Association; Flt Lt David Cretney; Wg Cdr J. Croshaw; Sgt A. W. Gough and Sgt John Williamson. It is hoped that Air Chief Marshal Sir Theodore McEvoy, Air Secretary and RAFGSA President, will also take part.

An outstanding flight was made last month by an RAFGSA pilot to an altitude of 25,900ft in an Olympia 2B. The pilot was Plt Off Ian Strachan, a Valiant pilot of 207 Sqn based at Marham, whose flight was cut short by his running out of oxygen. After an aerotow to 1,600ft on June 5 from Marham, where he glides with the Fenlands Club, Plt Off Strachan gained height rapidly by entering two cumulo-nimbus clouds. In the second cu-nim the climb above 16,000ft was made without the aid of the artificial horizon, the batteries of which had become exhausted during the first climb. At the peak height the air-brakes were opened and a quick descent was started. According to an Air Ministry press release, Plt Off Strachan said later: "As I descended I suddenly felt thirsty, so I opened the little window in the cockpit, broke a piece of ice off the aircraft, and sucked it."

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. The names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

Supersonics—and After

ON both sides of the Atlantic military programmes for large supersonic aircraft have been cancelled or cut back during the past year, and manufacturers are appealing to airlines and governments to support the design of Mach 3 passenger transports instead. On this side of the Atlantic they are urged on the grounds of Free World prestige. In Britain, patriots have called for no less than a national effort to build a supersonic Brabazon. (I still think the best comment on this one was written by Robert Blackburn in the correspondence columns of *Flight* for April 3, 1959).

You have mentioned more than once the cold remarks about trisonics by Mr Shenstone of BEA, who pointed out that the normal progression of technical development produces a new type of transport about every five years, each with 40 per cent more speed than the last. That is to say, the next generation of transports should be entering service around 1965, and fly at only 700kt (Mach 1.2). There the matter seems to have been left, but we can project the argument much farther to see where we may be going.

Doubling the speed every ten years, as in the past, means that tickets for Mach 3 travel will not be on sale in the Free (or other) World before 1975-1980. Ten years later we can expect genuinely hypersonic airliners, cruising faster than Mach 5.

Beyond this point, however, the important reference velocity is not the speed of sound (573kt in the stratosphere) but the low-level orbiting speed around the earth (15,350kt). The present writer has proposed calling the ratio of flight speed to this latter reference the Sanger number (S), after the man who first described its significance (1943). When flying at near-orbiting speeds the weight of vehicles and passengers, and thus also the aerodynamic lift required, decrease as the fraction $\sqrt{(1-S^2)}$. The analogy with Mach number is fairly close, for aerodynamic lift in subsonic flight increases as the inverse of $\sqrt{(1-M^2)}$.

Following this forecast to the year 1995, some transports will then be flying at speeds of 8,000kt (S=0.37), at which speed the passengers will feel 7 per cent lighter. Presumably by that date enough will be known about space psychology to keep their behaviour under control. Not until 2010, fifty years from now, will it be possible to buy a seat on a truly orbiting craft—by which time most of us will be happy to leave such travels to the younger set. One may doubt, of course, the value of whirling around the world in 80 minutes, considered as "transportation," but the speed will certainly be available for travel to somewhere.

Of great importance to manufacturers and airlines alike is that, in spite of the rising traffic totals, the work-capacity of these high-speed vehicles is so great that ever-decreasing numbers will be required. There will not eventually be room for more than one or two large aircraft manufacturers in the whole world, nor for more than one or two intercontinental airlines.

Of course, this trend applies at the other end of the speed scale, too. A very small fleet of three or four turboprop-powered 300kt ferry-boats, lifting a thousand straphanging weekenders at a time, would put hundreds of nineteenth-century ships and trains out of business overnight—and it is a wonder to me nobody is doing it.

Fairfield, Conn — J. M. STEPHENSON

The Challenge from France

THE June 17 issue of *Flight* is one of the most significant for many months. In it was detailed the new French challenge to Britain's aircraft industry. France is indeed revealed as a formidable rival with whom we must reckon in our struggle to maintain the present level of our aeronautical exports.

It is timely that we should now recognize this challenge and consider our answer to it. The best answer seems to lie in our lead in the field of VTOL. The military leaders of the world are beginning to appreciate the revolutionary implications of VTOL aircraft and the first nation to perfect them seems set fair to do business on a grand scale in the years ahead. If we strive to maintain our lead we have at our command the means of maintaining our industry at its present strength. To exploit this situation, however, we must abandon Mr Sandys's ideas about "co-operation" with Europe in this field. This "co-operation" seems to amount to a gift of British know-how to our Continental competitors as a gesture of goodwill towards the Common Market six. This is politically naive and commercially suicidal. If our trump card is used to accelerate a flow of VTOL aircraft from factories all over Europe then, too, the outlook is darkened considerably.

On the more hopeful side, France is now seen to be thoroughly competent as a potential partner in the development of supersonic airliners. In this field Britain and France have equally much to contribute and much to gain. Not only would the problems of financing development be eased but the expanded home market for such a project would see it off to a much surer start. The time seems ripe for BOAC, Air France, the two governments and representatives of the two industries to get together and decide what is wanted and how and when it can best be provided.

Surbiton, Surrey — A. J. FEREDAY

Aerobatic Take-offs?

SOME jargon is unavoidable, and it is even useful when it can employ a short word or phrase to explain a more complicated concept. Other jargon is misleading, and sounds like an attempt by experts to keep their knowledge from ordinary mortals, perhaps with a view to blinding them with science!

A fairly new example of the latter is "rotation," as applied to take-offs. When I read about the speed of rotation of a modern jet aircraft on take-off, I immediately think of the thing doing slow rolls or ground loops. The last thing that occurs to me is that reference is being made to a simple action of raising the nosewheel from the runway, a custom not peculiar to jets.

Why not call it "nose-up" speed? This is self-explanatory, and it has one less syllable than "rotation." It can be abbreviated to V_N instead of the V_R which is now creeping in.

Please can you use the influence of your columns to stop the insidious insertion of an ungainly usage into the English language?

Rome — C. B. H. BARFORD

[Sorry, too late. "Rotation" has been widely adopted by the world's airlines, and will soon be as firmly entrenched as is the word "alternate" when used to describe an alternative airfield.—Ed.]

Landing-Accident Prevention

WITH reference to a news-item (*Flight*, May 20, page 700) in which mention was made of a Comet 4 landing with wheels retracted: the undersigned, as a serving RCAF officer, has been granted authority to patent a simple, foolproof system that will prevent virtually all inadvertent wheels-up accidents.

This system could best be tailored to most training and fighter-class jet aircraft, as well as a few other types. Very likely it could replace the horn system on all aircraft. The device in no way interferes with normal operations; it merely lowers the wheels for landing whenever the pilot has neglected to do so, thus preventing these accidents.

Strong interest in this device includes the Services. Pending the appointment of a UK representative and the completion of patent action generally, the above preliminary facts may be of interest.

Ottawa. — A. P. HUCHALA, Sqn Ldr

Flashback to 1947

AS a regular reader of *Flight*, may I observe that the BSAA aircraft which, according to *The Times* report referred to in your issue of June 3 was missing since September 9, 1947, actually disappeared on August 2, 1947; and that this aircraft was not an Avro Tudor, but—according to all information published at the time—an Avro Lancastrian.

Berne, Switzerland — ARTHUR FLURY

[The report referred to the finding of wreckage on a mountain.—Ed.]

FORTHCOMING EVENTS

July 1-4. Palermo Aero Club: Aerial Tour of Sicily.
July 2-3. Flying Doctors' Meeting, Vittel.
July 2-4. Royal Aero Club: Invitation Rally, St Gatien, Deauville.
July 2-10. West Aero Club of France: Gliding Competition, Angers.
July 6. Kronfeld Club: "Introduction to Ballooning," by Kenneth Owen.
July 7-10. International Light-aircraft Show, Venice.
July 8. RAeS Astronautics and Guided Flight Section: a.g.m. and Lecture: "The US Space and Astronautics Programme," by Capt Robt. F. Freitag, USN.
July 8. College of Aeronautics: Presentation Day and Ball.
July 8-9. Royal Aero Club: Lockheed International Aerobatic Competition and King's Cup Race, Baginton.
July 8-10. Italian Aero Club Competition.
July 9. RAFA and Exeter Airport Ltd: Display, Exeter.
July 9-10. Basse Normandie Aero Club Rally, Flers.
July 10. Elstree Flying Club: Pilot's Rally, Elstree Aerodrome.
July 10. Leicestershire Aero Club At Home, Leicester East/Oadby.
July 16. Parachuting Competition, Woburn Abbey.
July 17. Royal Aero Club Rally, Woburn Abbey.
July 23. Army Air Corps: Open Day, Middle Wallop, Hants.
July 23-24. Trento Aero Club: 10th Aerial Circuit of the Dolomites.
July 24-August 1. Gliding Weeks: Yorkshire GC., Sutton Bank; London GC., Dunstable; Derby and Lancs GC., Camphill.
July 30-August 7. Inter-Services GC.: Gliding Week, Lasham.
July 31-August 7. Bulgarian Aero Club: World Parachuting Championships, Mousatchevo, near Sofia.